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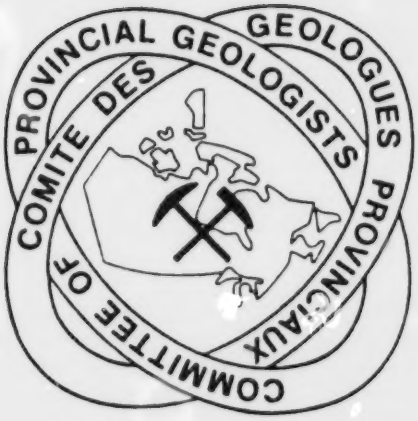
1988

PROVINCIAL GEOLOGISTS JOURNAL
JOURNAL DES GÉOLOGUES PROVINCIAUX



VOLUME 6

PUBLICATION ANNUELLE DU
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PUBLISHED ANNUALLY BY
COMMITEE OF PROVINCIAL GEOLOGISTS

91-03358/

AVANT-PROPOS

Le ministère de l'Énergie et des Ressources du Québec vous présente ce 6ième volume du Journal des géologues provinciaux, lequel demeurera le témoin d'une étape dans l'évolution des organisations géoscientifiques provinciales du Canada.

Les informations contenues dans ce volume ont été colligées grâce à la participation de C. Sturko and W. R. Smyth, Ministry of Energy, Mines and Petroleum Resources, British Colombia; J. Boon, Energy and Natural Resources, Alberta; M. Grant, Ministry of Northern Development and Mines, Ontario; P.S. Giles, Department of Mines and Energy, Nova Scotia; W.D. McRitchie, Department of Mines and Energy Manitoba; E.V. Jackson, Department of Natural Resources, New Brunswick; J.-L. Caty, Ministère de l'Énergie et des Ressources, Québec ainsi que de leurs collaborateurs respectifs.

L'édition des textes et la publication du volume sont l'oeuvre de Patrick Rissmann et de son équipe du Service de la géoinformation du MERQ.

Le Journal des géologues provinciaux est disponible dans chaque province et territoire, aux comptoirs gouvernementaux habituels où est diffusée l'information géoscientifique.

Le sous-ministre adjoint
Exploration géologique et minérale
Ministère de l'Énergie et des Ressources (Mines)
Québec

Robert Y. Lamarche

FOREWORD

The Ministère de l'Énergie et des Ressources, Québec, is pleased to present Volume 6 of the Provincial Geologists Journal, wich will bear evidence of progress in the evolution of the provincial geoscientific organizations of Canada.

The information put together in this volume was collected with the participation of C. Sturko and W. R. Smyth, Ministry of Energy, Mines and Petroleum Resources, British Colombia; J. Boon, Energy and Natural Resources, Alberta; M. Grant, Ministry of Northern Development and Mines, Ontario; P.S. Giles, Department of Mines and Energy, Nova Scotia; W.D. McRitchie, Department of Mines and Energy Manitoba; E.V. Jackson, Department of Natural Resources, New Brunswick; J.-L. Caty, Ministère de l'Énergie et des Ressources, Québec and their collaborators.

Special thanks go to Patrick Rissmann and his team, of the Service de la géoinformation of the Ministère de l'Énergie et des Ressources, Québec, for editing and compiling the present volume.

The Provincial Geologists Journal is available in each province and territory through their respective governmental distribution centers for geoscientific information.

Le sous-ministre adjoint
Exploration géologique et minérale
Ministère de l'Énergie et des Ressources (Mines)
Québec

Robert Y. Lamarche

THE COMMITTEE OF PROVINCIAL GEOLOGISTS
CHAIRMAN'S REPORT 1988

The Committee consists of the chief geologists, or their equivalents, of the provincial and territorial geological surveys in Canada. During 1988, the Committee met twice; during the Prospectors and Developers Association of Canada (PDAC) Convention that was held in Toronto in March, and in August during the Mines Ministers' Conference in Quebec City.

The Committee provides forum for the discussion of geological affairs between the provinces and territories, and maintains an effective liaison with industry on matters relating to mineral exploration and development.

Volume five of the Provincial Geologists Journal was published. The Journal is a prime source for provincial and territorial geoscience organization charts, geological survey expenditures, geological program highlights, hard rock drillcore programs and other provincial geoscience information.

The Committee organized the provincial Activities Session at the Prospectors and Developers Association of Canada Convention, where member representatives presented the papers listed below.

— Gold Mineralization in Newfoundland — J. Tuach, Government of Newfoundland and Labrador, Department of Mines.

— Vegetation Geochemistry and Gold Exploration in Manitoba — M.A.F. Fedikow, Geological Services Branch, Minerals Division.

— Gold Skarns in British Columbia and the Global Gold Rush — G.E. Ray (speaker), A. Ettlinger and G.L. Dawson, B.C. Ministry of Energy, Mines and Petroleum Resources.

— Recent Developments in Precious Metal Exploration in New Quebec - T. Clark, M. Bélanger (speaker), D. Lamothe, L. Kish and P. Marcoux, Ministère de l'Énergie et des Ressources.

— Gold Deposition Related to Crustal Thickening along Major Tectonic Boundaries in New Brunswick - A.A. Ruitenberg (speaker), and L.R. Fyffe, N.B. Department of Natural Resources and Energy.

— The Role of Geology in Assisting Archean Gold Exploration in Ontario - A.C. Colvine (speaker) and Staff, Ontario Geological Survey.

— Uranium-Gold-Platinum Metal Mineralization in the Beaverlodge District, Saskatchewan - T. Sibbald, Saskatchewan Department of Energy and Mines.

All provinces and territories, with the exception of Prince Edward Island, had poster displays in the «Provincial Room» during the three days of the convention. These provincial poster sessions have become a tradition at the PDAC Convention and draw larger crowds every year. They generate a substantial amount of interest in the provinces' mineral resource potential.

The Committee reviewed its terms of references and submitted an updated version to the Mines Ministers for their approval.

Liaison was maintained with the Prospectors and Developers Association of Canada, with the Canadian Geoscience Council and the Geological Survey of Canada, the latter through the National Geological Surveys Committee (NGSC). Suggestions made to the Committee of Provincial Geologists by the PDAC led the NGSC to establish two technical subcommittees: one on Aeromagnetic Contract Survey Standards and one on Aeromagnetic Data Base Standards. Through the NGSC, the Committee is contributing to the standardization of map symbols and hopes to publish a list of symbols common to all provinces and the GSC and lists of symbols unique

to each province in the Provincial Geologists Journal, and to update these lists yearly. In its brief to the Mines Ministers conference, the Committee drew attention to the impact of the advent of GeoScience Information Systems (GSIS) on the future of geoscience activities. Through the NGSC, the Committee participated in a GSIS workshop at which national coordination of GIS development and implementation was discussed.

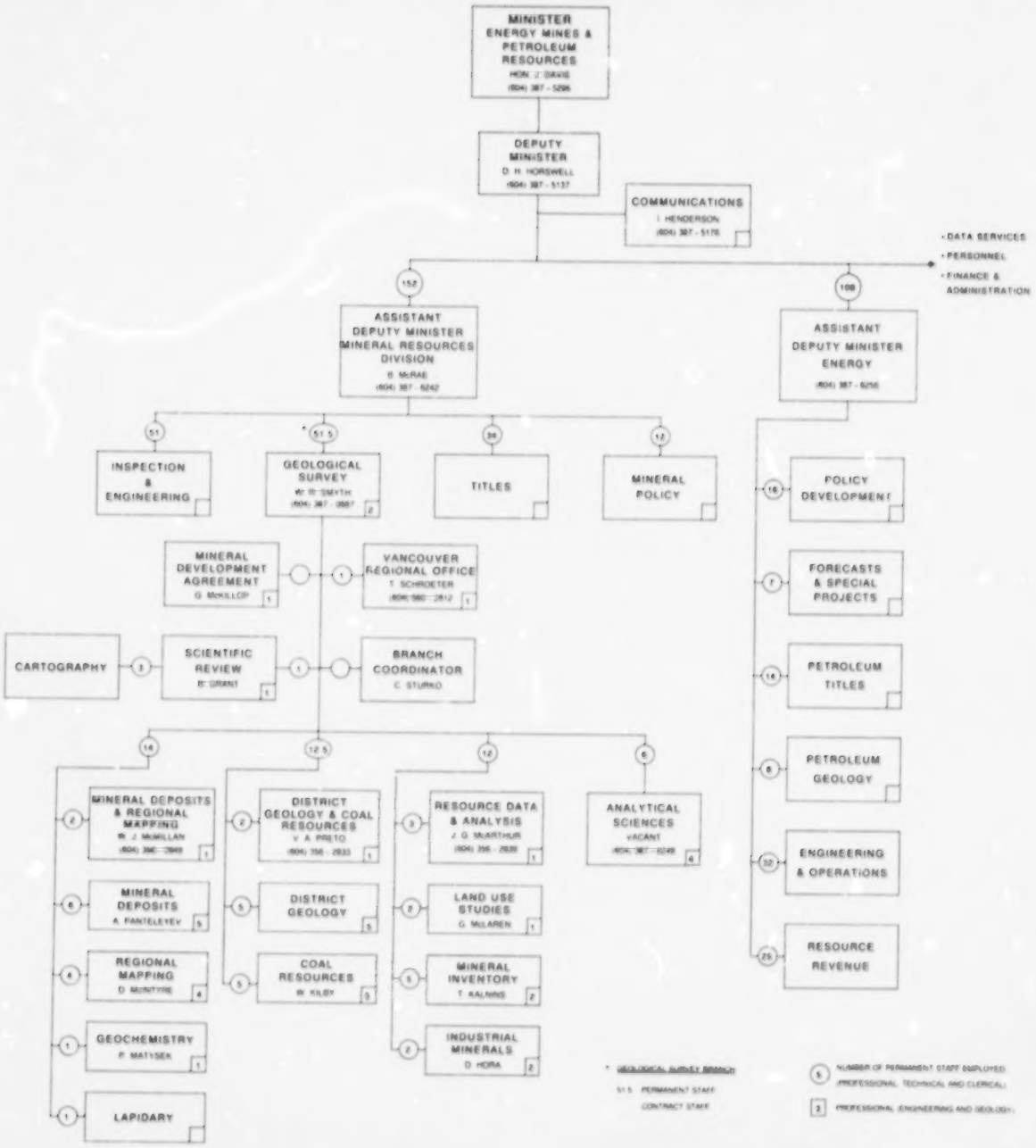
During 1988, Dr. André Laurin, who represented Quebec on the Committee, resigned. The Committee expresses its gratitude to André for his constructive contributions over the many years that he was a member.

Jan Boon, Chairman
Committee of Provincial Geologists

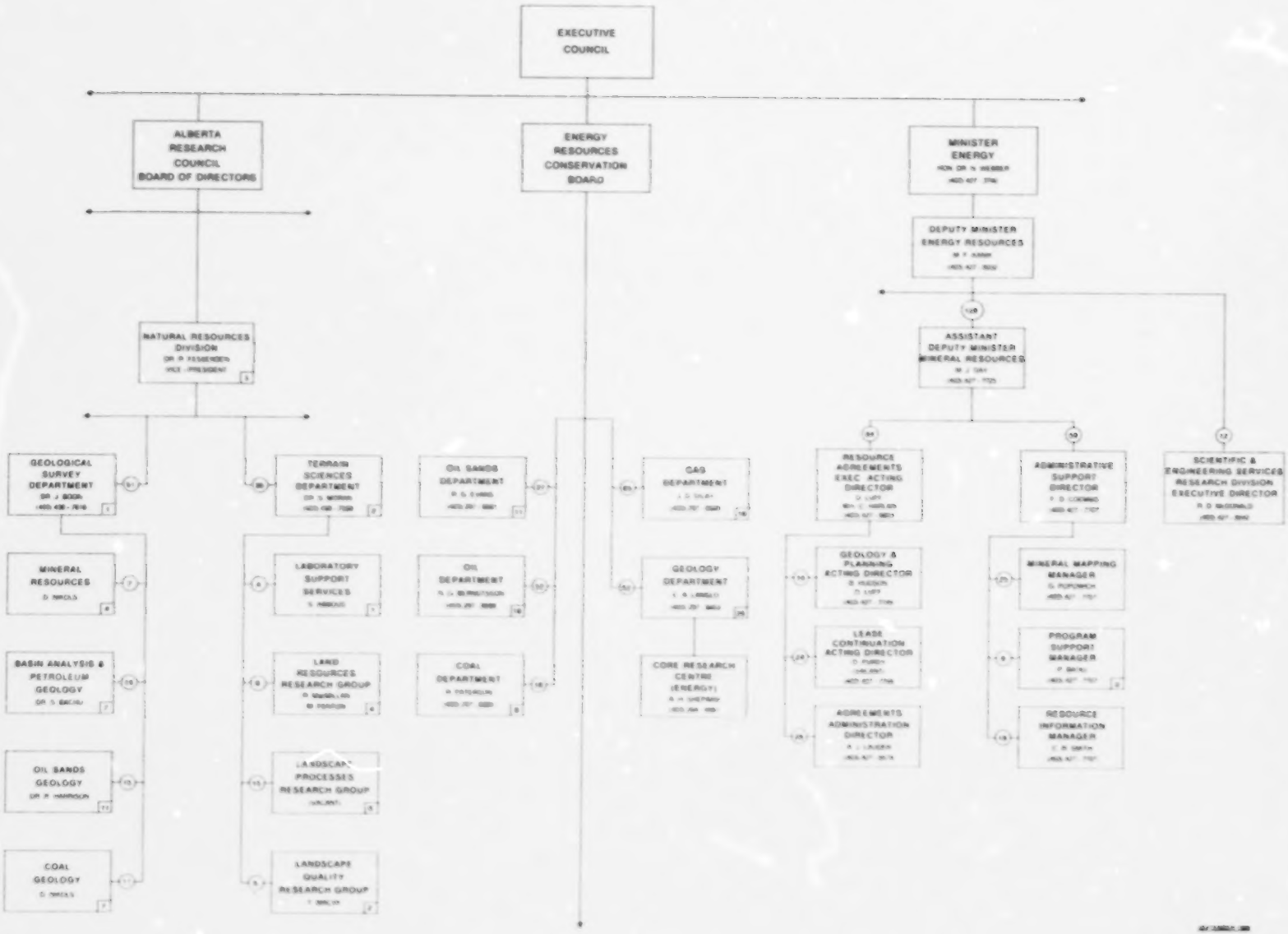
GEOSCIENCE ORGANIZATION CHARTS

Each provincial and territorial government in Canada has developed its own organizational structure for conducting geoscientific survey and research work. Some provinces have what is formally called a Geological Survey (e.g. Ontario Geological Survey), but in most jurisdictions the main elements of the geological survey function are embraced in one or more Branches or Divisions of provincial Mines/Energy/Natural Resources Departments (e.g. the British Columbia Ministry of Energy, Mines and Petroleum Resources is divided into a Mineral Resources Division and a Petroleum Resources Division, with the bulk of geological survey and research work conducted in the Geological Branch of the Mineral Resources Division. The following organization charts are set out in standard format to help alleviate confusion amongst potential users of provincial geoscience services. The charts contain reference to the lines of reporting of the various units in each hierarchy, the manpower associated with each separate jurisdiction, and the names and telephone numbers of key individuals in each system.

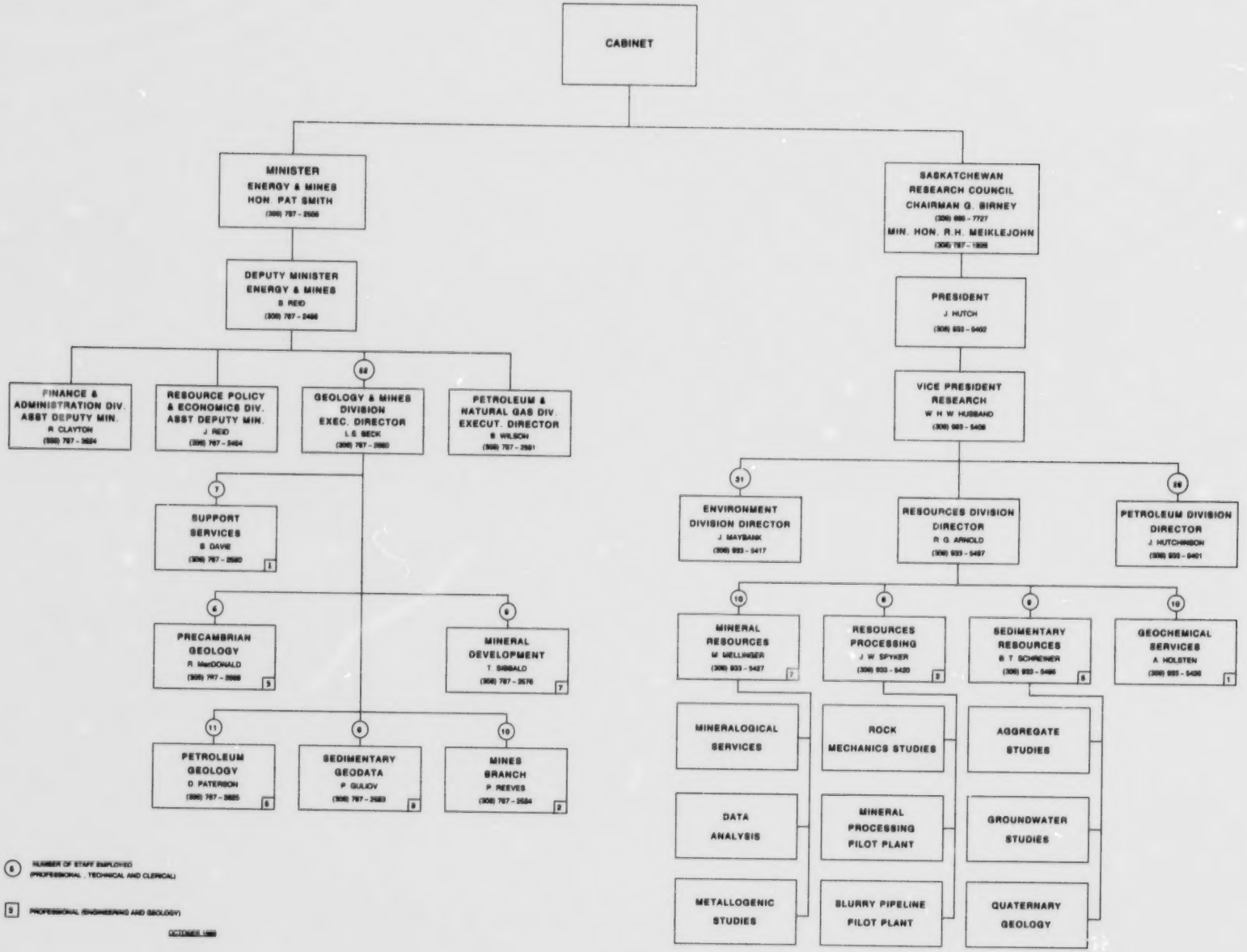
BRITISH COLUMBIA GEOSCIENCE ORGANIZATION CHART



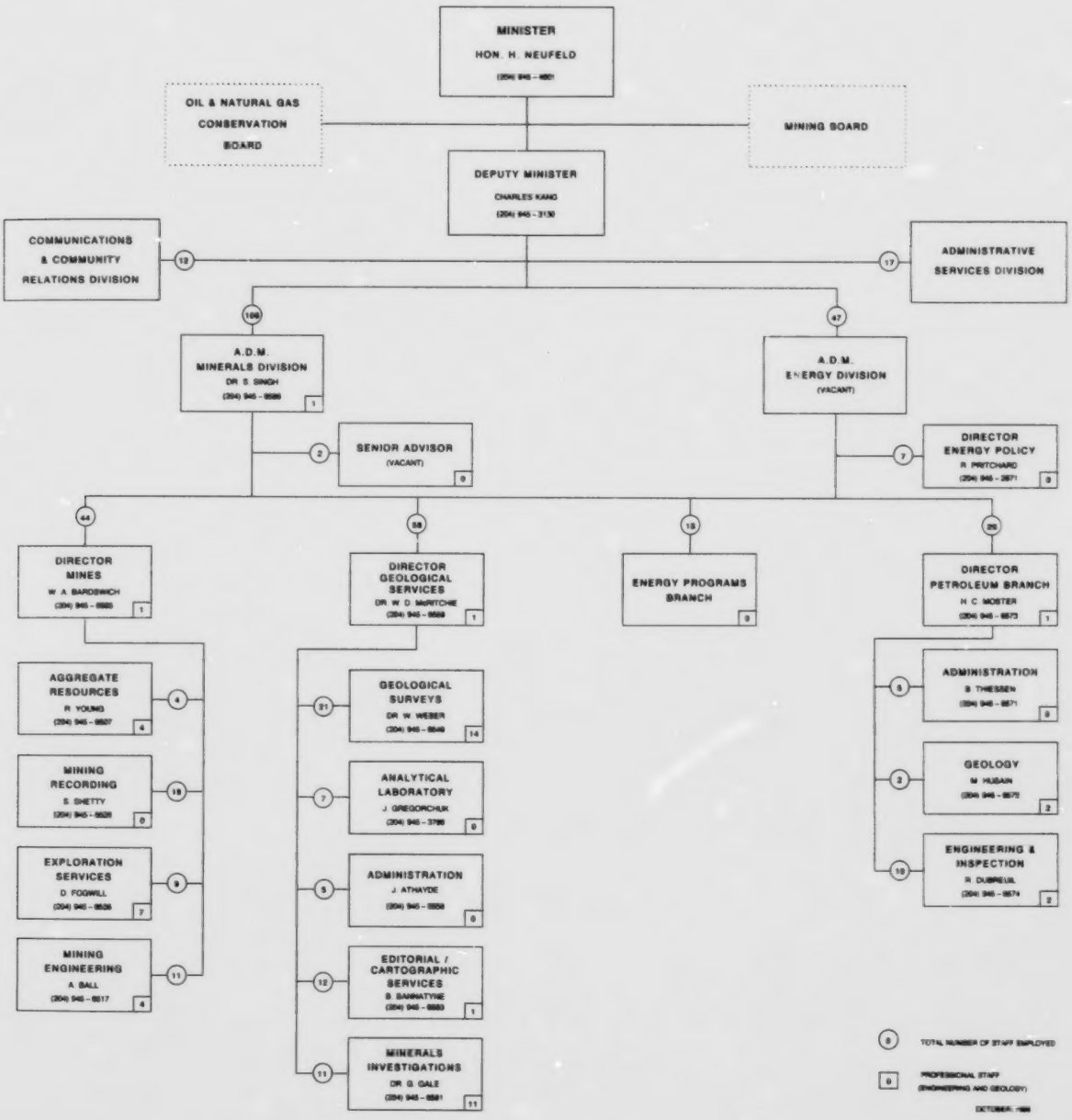
ALBERTA GEOSCIENCE ORGANIZATION CHART



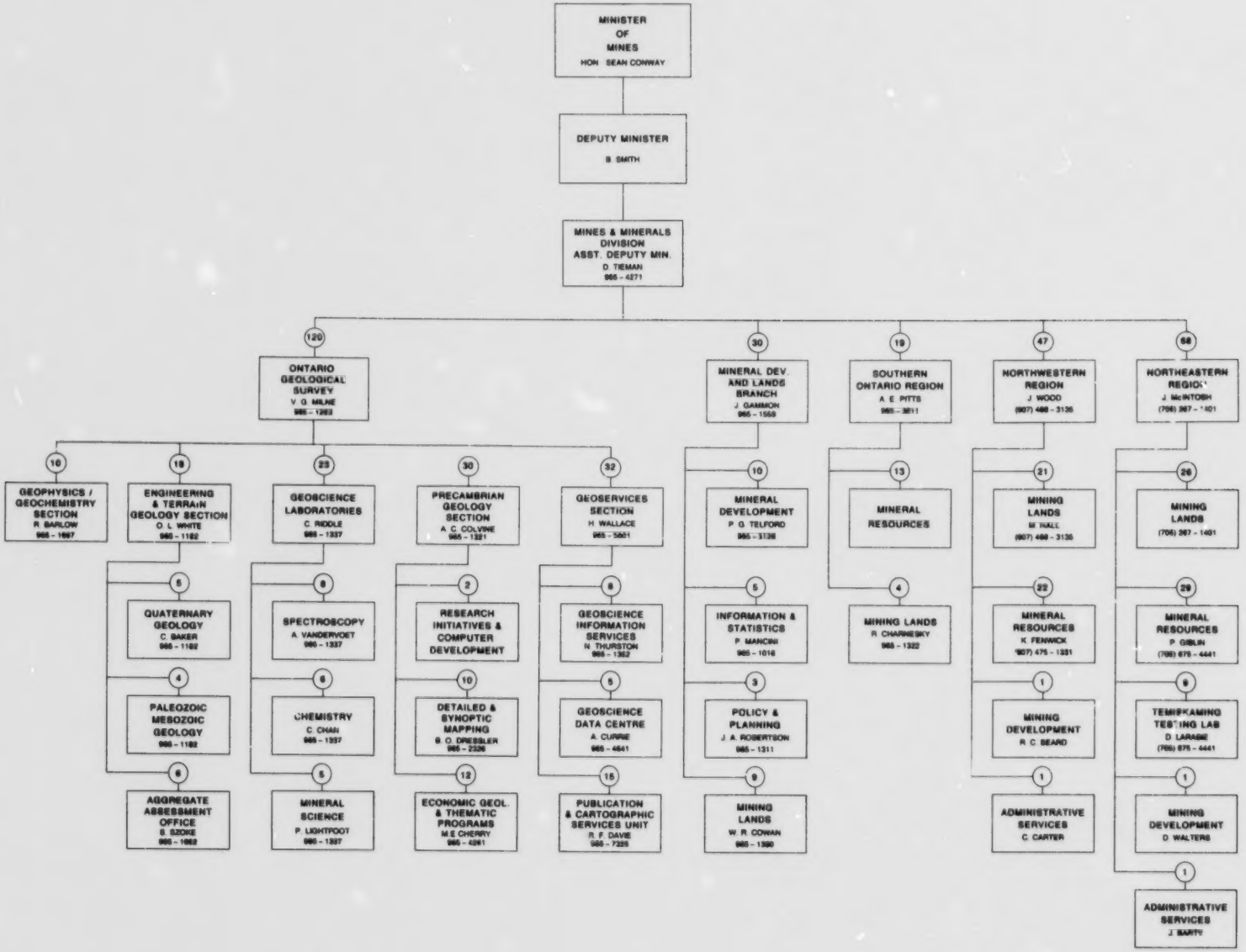
SASKATCHEWAN GEOSCIENCE ORGANIZATION CHART



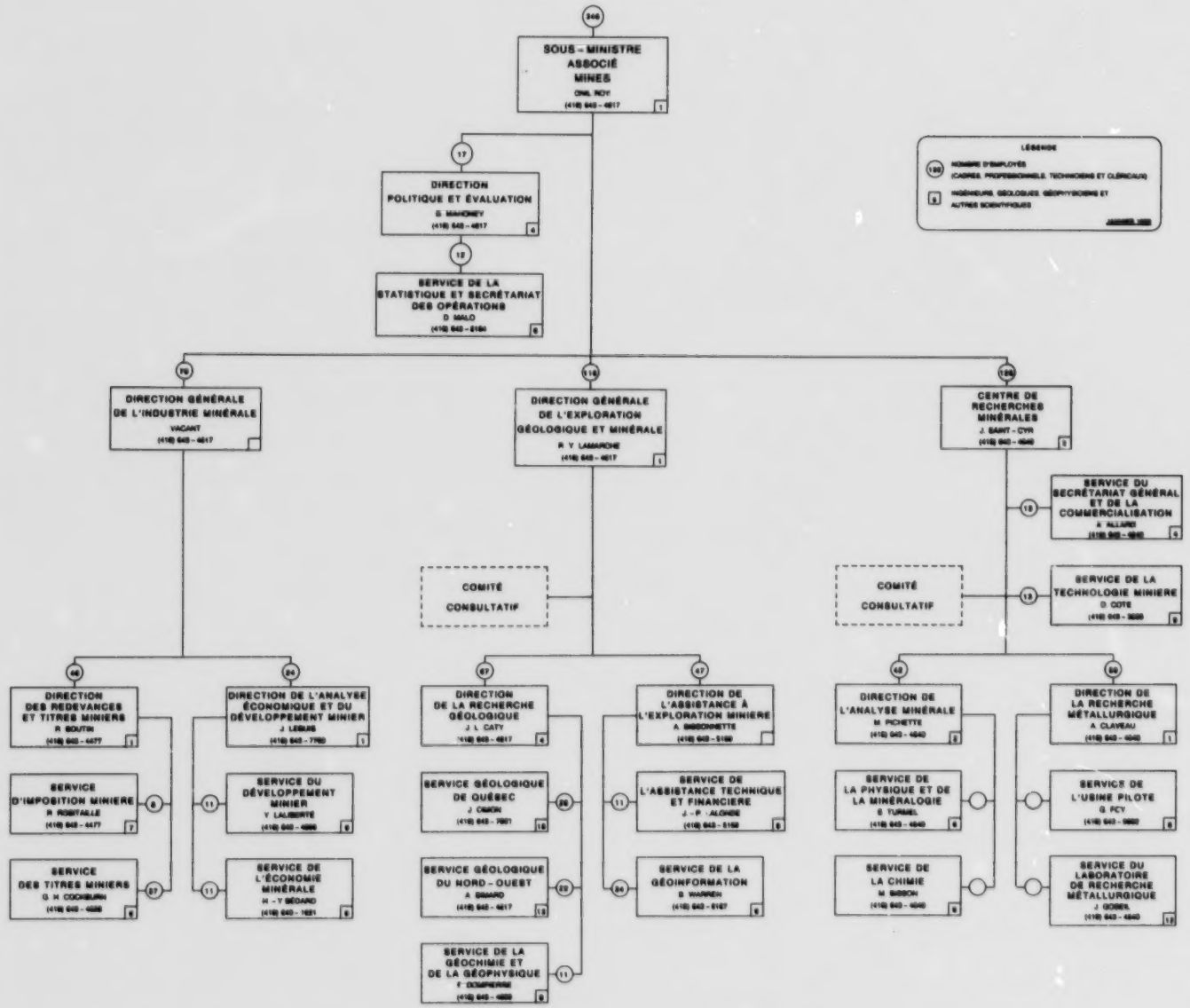
MANITOBA GEOSCIENCE ORGANIZATION CHART



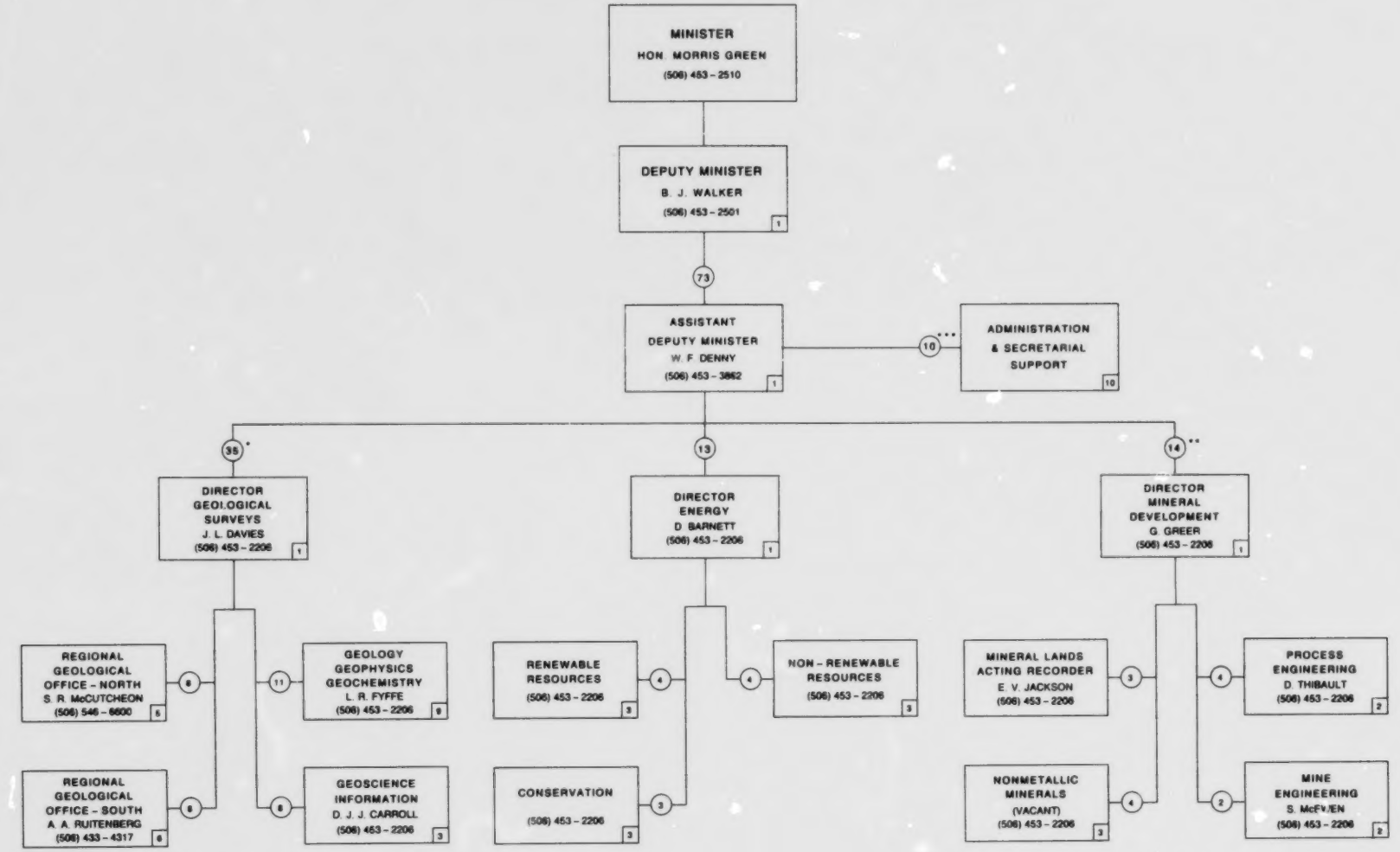
ONTARIO GEOSCIENCE ORGANIZATION CHART



ORGANIGRAMME GÉOSCIENCE DU QUÉBEC


SOUS – MINISTRE ASSOCIÉ MINES
DIRECTION POLITIQUE ET ÉVALUATION
SERVICE DE LA STATISTIQUE ET SECRÉTARIAT DES OPÉRATIONS
DIRECTION GÉNÉRALE DE L'INDUSTRIE MINÉRALE
DIRECTION GÉNÉRALE DE L'EXPLORATION GÉOLOGIQUE ET MINÉRALE
CENTRE DE RECHERCHES MINÉRALES
SERVICE DU SECRÉTARIAT GÉNÉRAL ET DE LA COMMERCIALISATION
SERVICE DE LA TECHNOLOGIE MINIÈRE
COMITÉ CONSULTATIF
COMITÉ CONSULTATIF
DIRECTION DES REDEVANCES ET TITRES MINIERS
DIRECTION DE L'ANALYSE ÉCONOMIQUE ET DU DÉVELOPPEMENT MINIER
DIRECTION DE LA RECHERCHE GÉOLOGIQUE
DIRECTION DE L'ASSISTANCE À L'EXPLORATION MINIÈRE
DIRECTION DE L'ANALYSE MINÉRALE
DIRECTION DE LA RECHERCHE MÉTALLURGIQUE
SERVICE D'IMPOSITION MINIÈRE
SERVICE DU DÉVELOPPEMENT MINIER
SERVICE GÉOLOGIQUE DE QUÉBEC
SERVICE DE L'ASSISTANCE TECHNIQUE ET FINANCIÈRE
SERVICE DE LA PHYSIQUE ET DE LA MINÉRALOGIE
SERVICE DE L'USINE PILOTE
SERVICE DES TITRES MINIERS
SERVICE DE L'ÉCONOMIE MINÉRALE
SERVICE GÉOLOGIQUE DU NORD – OUEST
SERVICE DE LA GÉOINFORMATION
SERVICE DE LA CHIMIE
SERVICE DU LABORATOIRE DE RECHERCHE MÉTALLURGIQUE
SERVICE DE LA GÉOCHIMIE ET DE LA GÉOPHYSIQUE
LÉGENDE

NEW BRUNSWICK GEOSCIENCE ORGANIZATION CHART



* INCLUDES TEN GEOLOGISTS AND ONE TYPIST SUPPORTED BY CANADA - NEW BRUNSWICK MINERAL DEVELOPMENT AGREEMENT FUNDS

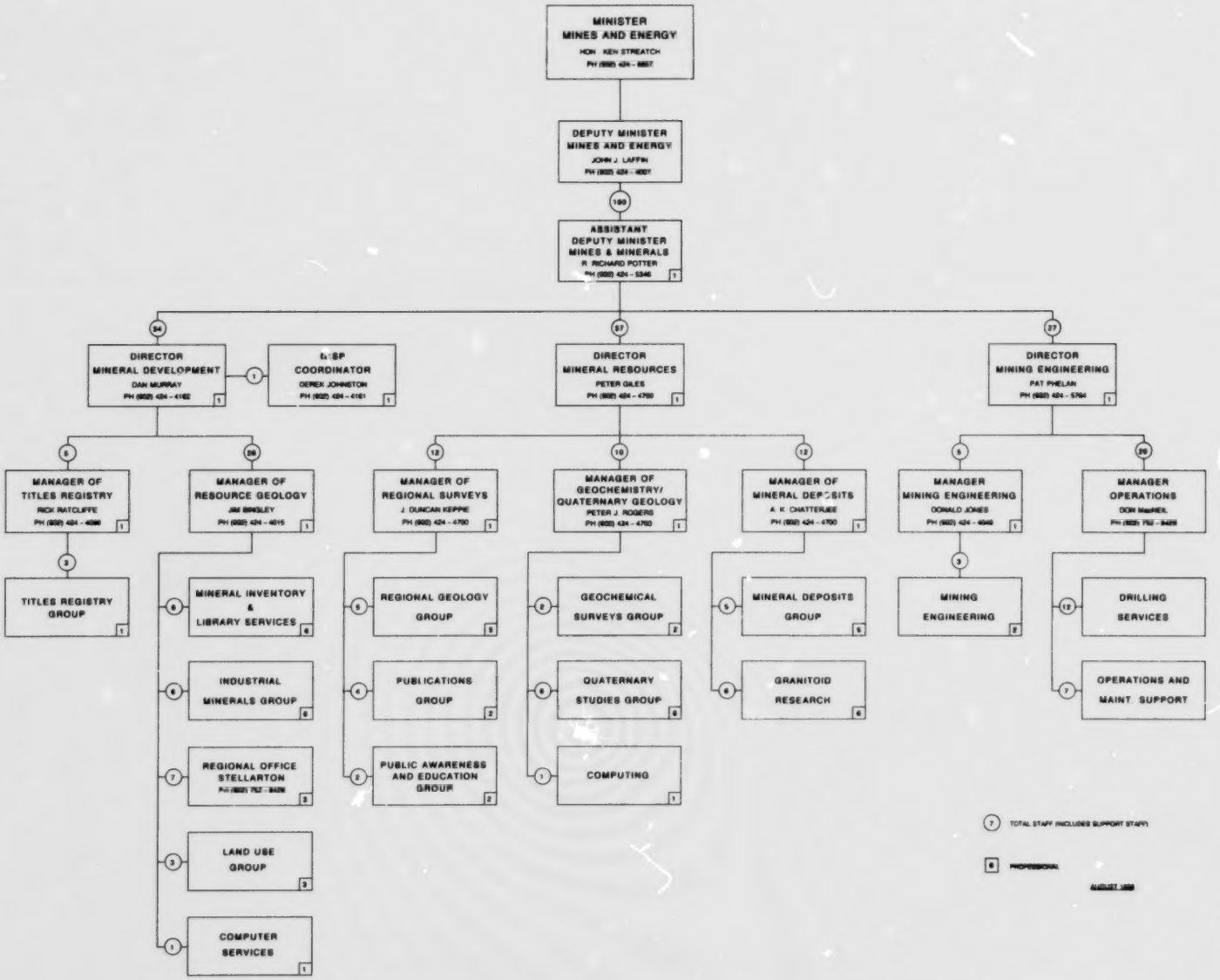
** INCLUDES THREE POSITIONS SUPPORTED BY CANADA - NEW BRUNSWICK MINERAL DEVELOPMENT AGREEMENT FUNDS

*** INCLUDES TWO POSITIONS SUPPORTED BY CANADA - NEW BRUNSWICK MINERAL DEVELOPMENT AGREEMENT FUNDS

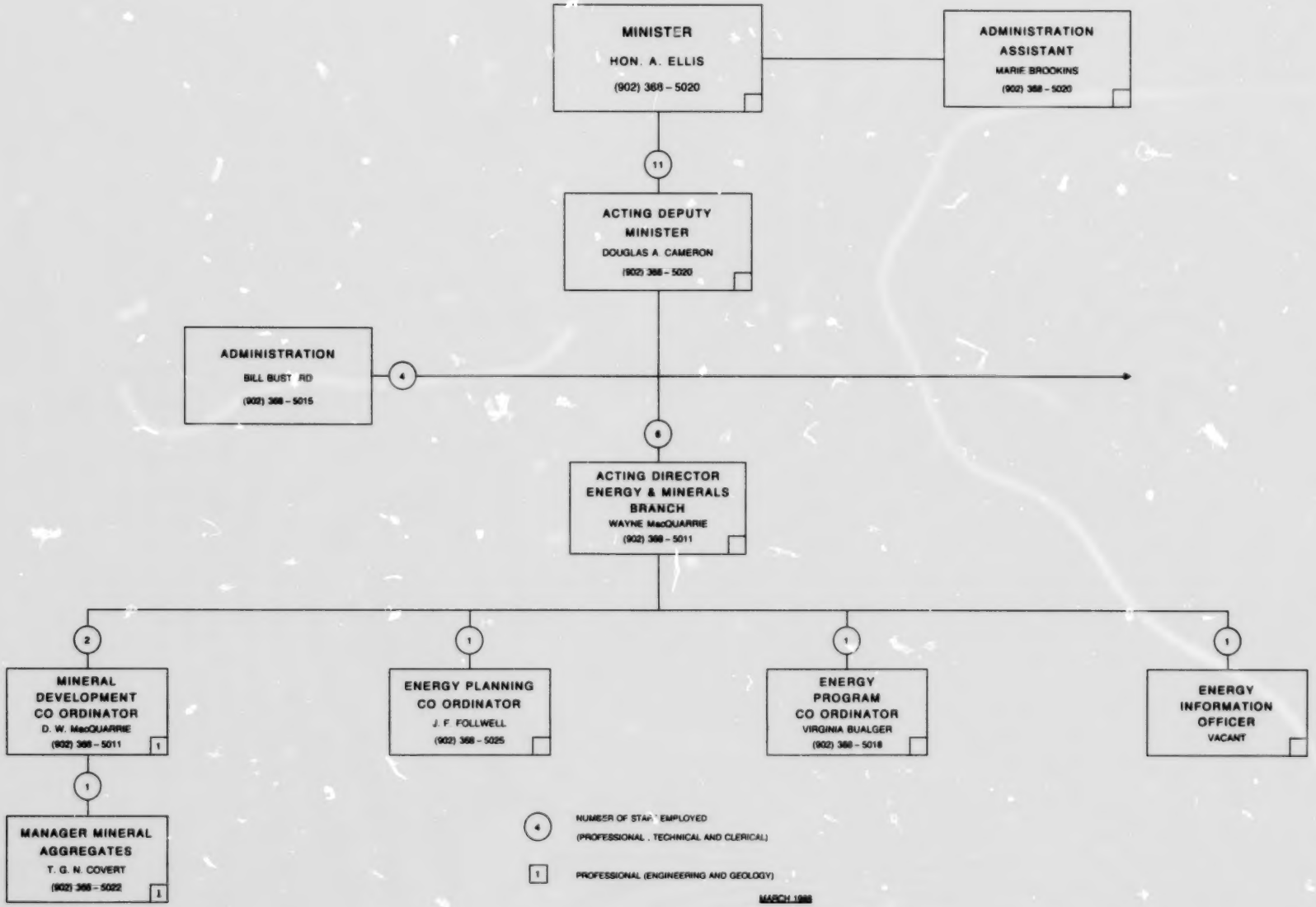
(2) TOTAL PROFESSIONAL, TECHNICAL AND CLERICAL STAFF

[2] TOTAL PROFESSIONAL STAFF

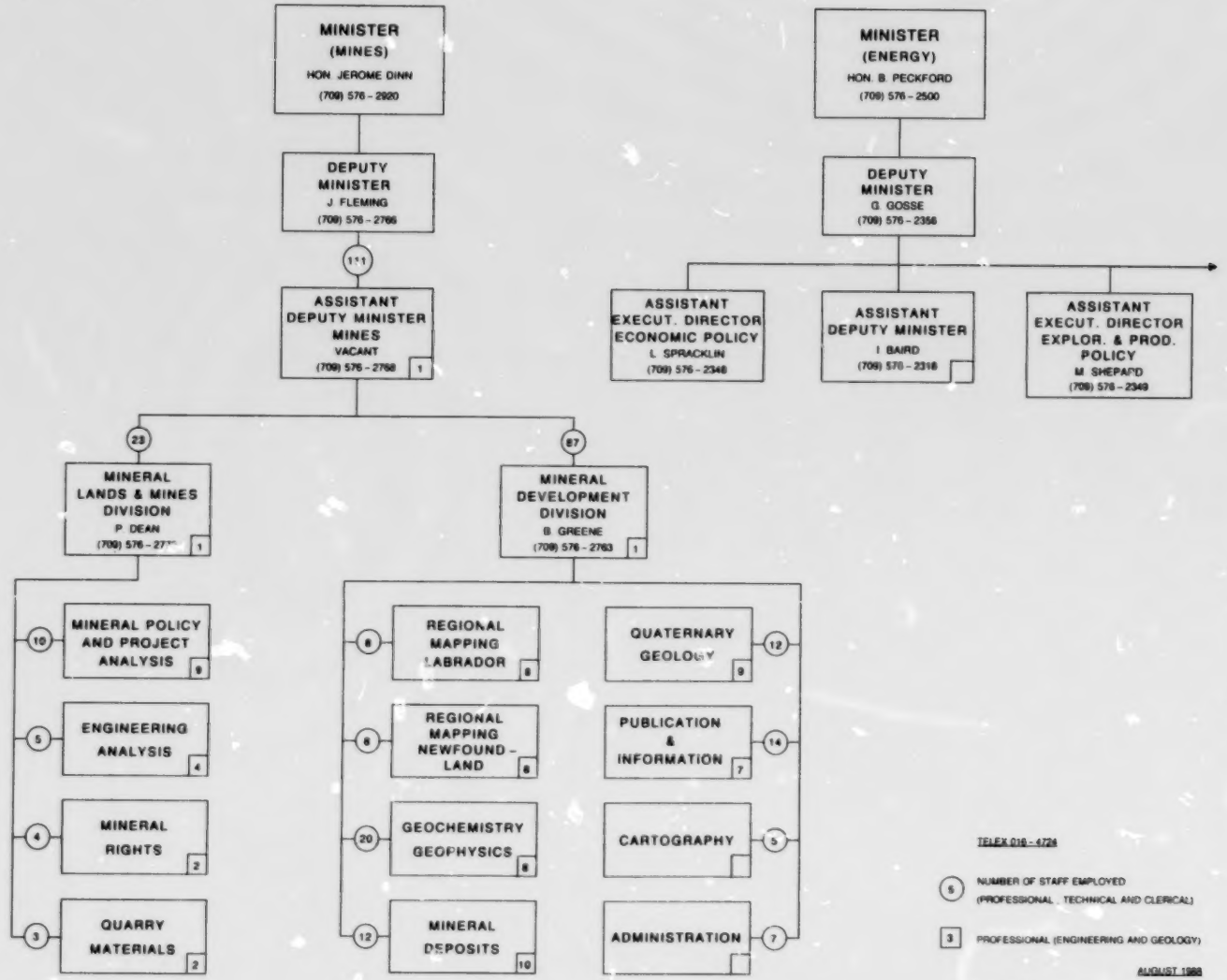
NOVA SCOTIA GEOSCIENCE ORGANIZATION CHART



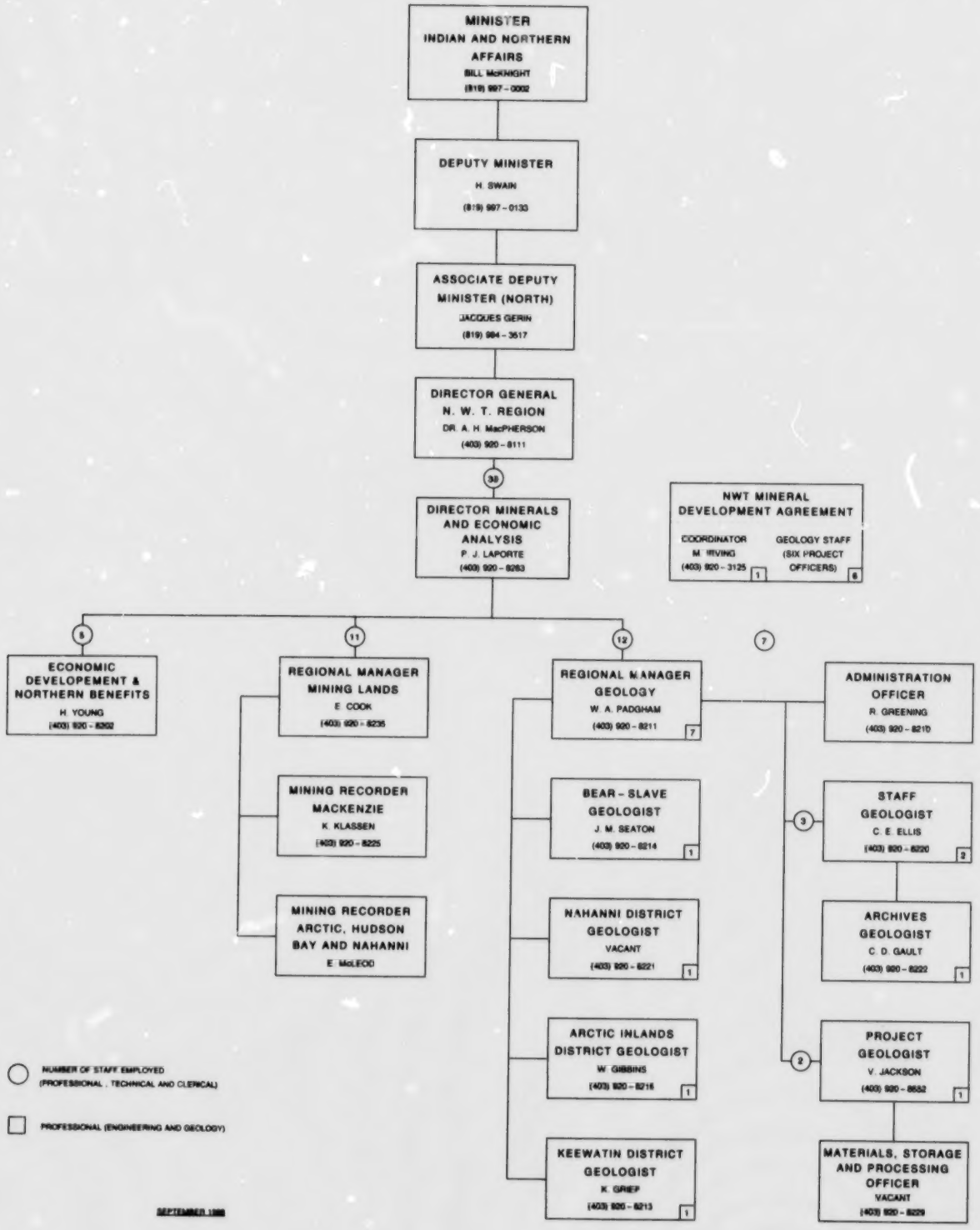
PRINCE EDWARD ISLAND GEOSCIENCE ORGANIZATION CHART



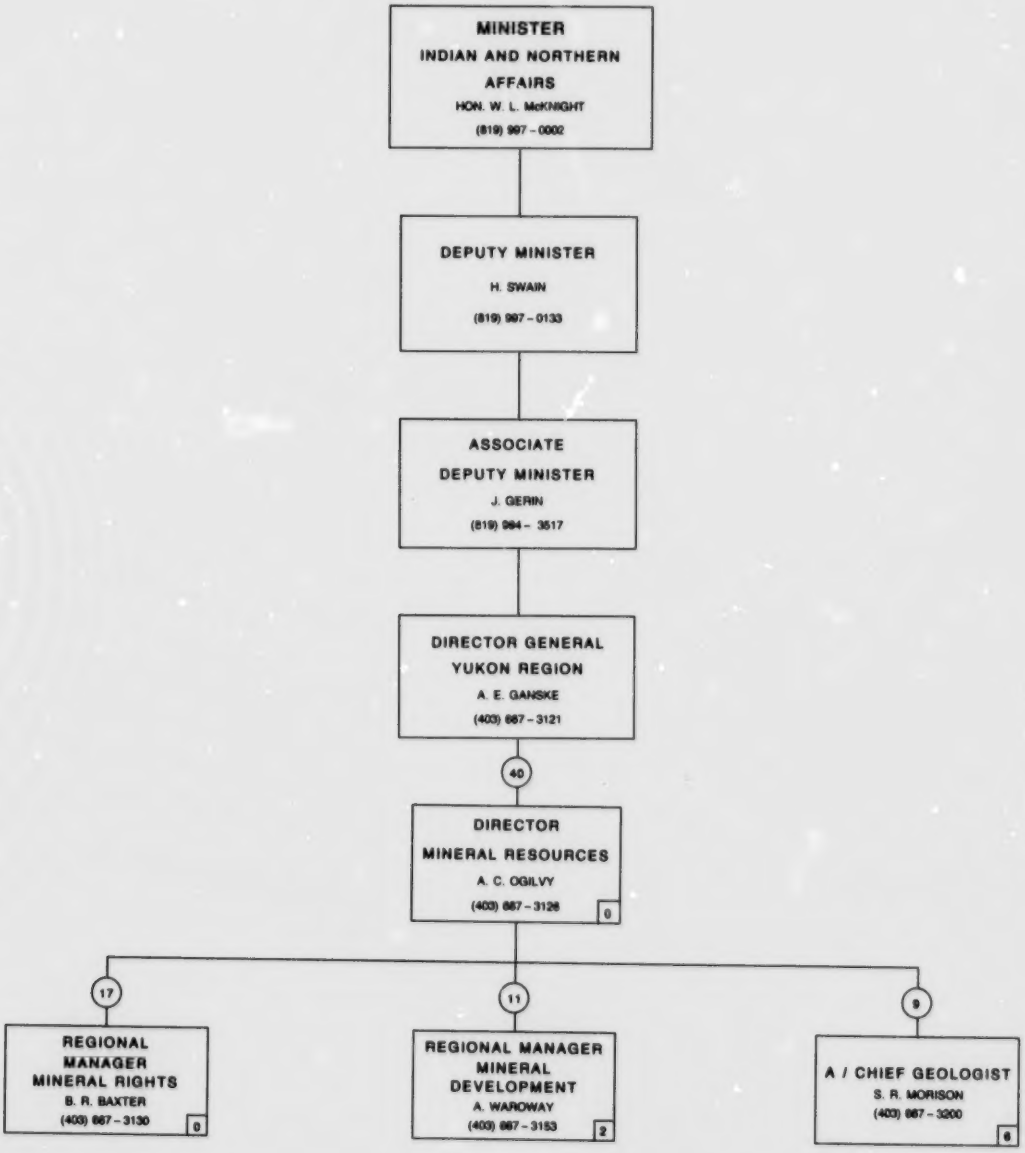
NEWFOUNDLAND GEOSCIENCE ORGANIZATION CHART



NORTHWEST TERRITORIES GEOSCIENCE ORGANIZATION CHART



YUKON GEOSCIENCE ORGANIZATION CHART



PROVINCIAL GEOLOGICAL SURVEY EXPENDITURES, 1987-1988

PROVINCIAL GEOSCIENCES EXPENDITURES
1987—1988

PROVINCE/ TERRITORY	SURVEY EXPENDITURES $ x 10^6	% OF TOTAL	TOTAL 1987 VALUE OF PROVINCIAL MINERAL PRODUCTION[1] $ x 10^3	SURVEY EXPENDITURES AS % OF TOTAL VALUE OF PROVINCIAL MINERAL PRODUCTION	AREA OF PROVINCE/ TERRITORY km^2 x 10^3	SURVEY $ SPENT/km^2	POPULATION (1986) x 10^3	SURVEY $ SPENT/ CAPITA
Newfoundland	5.5	7.1	767 816	0.72	405	13.5	568	9.7
Nova Scotia	5.6	7.3	389 647	1.44	55	101.8	873	6.4
Prince Edward Island	—	—	1 917	—	6	—	127	—
New Brunswick	2.3	2.9	700 696	0.33	73	31.5	709	3.2
Quebec	20.8	27.0	2 527 761	0.82	1 541	13.5	6 532	3.2
Ontario	18.1	23.5	5 575 651	0.32	1 069	16.9	9 102	2.0
Manitoba	3.5	4.5	909 252	0.38	650	5.4	1 063	3.3
Saskatchewan	3.2	4.2	1 461 220	0.22	652	4.9	1 010	3.2
Alberta	9.0	11.7	1 344 586	0.67	661	13.6	2 366	3.8
British Columbia	6.6	8.6	2 782 657	0.24	948	7.0	2 883	2.3
Yukon	1.0	1.3	447 204	.22	483	2.1	24	41.7
Northwest Territories	1.5	1.9	810 005	.19	3 380	0.4	52	28.8
TOTALS	**77.1**	**100**	**17 718 412**	—	**9 923**	—	**25 309**	—

[1]Source: Canadian Mining Journal, March 1988

PROVINCE: BRITISH COLUMBIA
1987—1988

PROGRAMS	SURVEY/ RESEARCH AGENCY	FUNDING AGENCY	NO. OF PROJECTS (OR FACILITIES)	PERMANENT[1] SMY	CASUAL SMY	SALARIES PERMANENT $	SALARIES CASUAL/ TEMPORARY $	OPERATING EXPENDITURES $	TOTALS $
Chief's Office	GB (MRD)	EMPR/ EMR	2	3	1	120 000	149 000	266 000	535 000
Core Repositories	GB (MRD)	EMPR	1[2]	—	—	—	—	—	—
Geochemical Surveys:									
(1) Bedrock	GB (MRD)	EMPR	—	—	—	—	—	—	—
(2) Drainage	GB (MRD)	EMPR/ EMR	5	1	2	50 000	191 000	394 000	635 000
(3) Soil	—	—	—	—	—	—	—	—	—
Geological Surveys, Bedrock:									
(1) Reconnaissance (>1:100 000)	—	—	6	3	18	150 000	552 000	536 000	1 238 000
(2) Detailed (>1:50 000)	GB (MRD)	EMPR/ EMR	24	15	13	595 000	373 000	820 000	1 788 000
(3) Coal	GB (MRD)	EMPR	9	6	5	250 000	168 000	162 000	580 000
Geological Surveys, Surficial:									
(1) Reconnaissance (>1:100 000)	—	—	—	—	—	—	—	—	—
(2) Detailed (>1:50 000)	GB (MRD)	EMPR	—	—	—	—	—	—	—
Geophysical Surveys:									
(1) Airborne Electromagnetic	—	—	—	—	—	—	—	—	—
(2) Airborne Magnetic	—	—	—	—	—	—	—	—	—
(3) Ground Magnetic	—	—	—	—	—	—	—	—	—
(4) Gravity	—	—	—	—	—	—	—	—	—
(5) Seismic	—	—	—	—	—	—	—	—	—
(6) Radiometric	—	—	—	—	—	—	—	—	—
Hydrogeological Surveys	OM	—	—	—	—	—	—	—	—
Education	GB (MRD)	EMPR	5	1	—	34 000	—	—	34 000
Laboratory Analysis	GB (MRD)	EMPR	8	7	1	231 000	20 000	139 000	390 000
Mineral Deposit Inventory and Analysis	GB (MRD)	EMPR/ EMR	3	7	10	300 000	143 000	338 000	781 000
Oil and Gas Inventory and Analysis	GB (PRD)	EMPR	1	4	—	200 000	—	38 000	238 000
Publications	EMPR	EMPR	50	1	—	—	—	—	—
District Geologist's Office/Coal Resources	GB (MRD)	EMPR	4	8	2	300 000	90 000	239 000	629 000
Petroleum Subsurface Investigations	GB (PRD)	EMPR	1	4	—	240 000	—	46 500	286 500
Water Resource Inventory and Analysis	OM	—	—	—	—	—	—	—	—
TOTALS									
GB (MRD)	—	—	—	**53**	**47**	**2 030 000**	**1 686 000**	**2 894 000**	**6 610 000**
GB (PRD)	—	—	—	**10**	—	**440 000**	—	**84 500**	**524 500**

[1]Full Time Employees
[2]Charlie Lake
GB (MRD) — Geological Branch (Mineral Resources Division)
GB (PRD) — Geological Branch (Petroleum Resources Division)
EMPR — Ministry of Energy, Mines and Petroleum Resources
OM — Other Ministries
EMR — Energy, Mines and Resources Canada
(Canada — B.C. Mineral Development Agreement)

PROVINCE: ALBERTA
1987—1988

PROGRAMS	SURVEY/ RESEARCH AGENCY	FUNDING AGENCY	NO. OF PROJECTS (OR FACILITIES)	PERMANENT SMY	CASUAL SMY	SALARIES PERMANENT $	SALARIES CASUAL $	SUPPLIES & SERVICES $
Chief's Office	ARC/ERCB	ARC/ERCB	2	4.39	—	280 417	—	66 468
*Core Repositories	ARC/ERCB	AE	2	40.77	.16	1 070 293	2 226	257 163
Geochemical Research/Surveys	ARC	ARC	—	—	—	—	—	—
Geological Surveys, Bedrock:								
(1) Reconnaissance (>1:100 000)	—	—	—	—	—	—	—	—
(2) Detailed (1:50 000)	—	—	—	—	—	—	—	—
Geological Surveys, Surficial:								
(1) Reconnaissance	ARC	ARC/AFLW	6	3.51	.03	236 617	457	73 469
(2) Detailed	ARC	ARC	—	—	—	—	—	
(3) Reclamation/Environmental Impact	ARC	ARC	9	9.11	—	607 539	—	120 600
Geophysical	—	—	—	—	—	—	—	—
Hydrogeological	ARC	ARC/AENV AOSTRA	5	3.11	—	290 613	—	89 503
Information and Education	ARC/ERCB	AE/ARC	1	.97	.25	52 910	13 871	13 086
Laboratory Analysis	ARC	ARC	1	1.92	—	78 697	—	4 122
Mineral Deposit Inventory and Analysis	ARC	ARC	2	.4	—	38 931	—	12 840
Energy Resource Inventory and Research:								
(1) Petroleum and Natural Gas	ARC/ERCB	ARC/ERCB	5	29.26	2.39	1 127 829	61 226	299 973
(2) Oil Sands	ARC/ERCB	ARC/AOSTRA AE	7	29.56	.61	1 622 530	20 787	399 263
(3) Coal Geology	ARC	ARC/AE	1	8.62	.94	609 165	32 839	180 301
Stratigraphic Research	ARC/ERCB	ARC/ERCB	2	6.27	.32	363 996	4 824	74 669
Other	ARC/ERCB	ARC/ERCB	9	13.14	.02	654 480	365	196 478
TOTALS	—	—	52	151.03	4.72	7 034 017	136 595	1 787 935

ARC — Alberta Research Council
AOSTRA — Alberta Oil Sands Technical Research Authority
AE — Alberta Department of Energy
AFLW — Alberta Forestry, Lands and Wildlife
AENV — Alberta Environment
ERCB — Energy Resources Conservation Board
CMRC — Coal Mining Research Centre

*Change in expenditures due to omission of ERCB Core Repository information in the Provincial Geologists Journal, vol. 5, 1987.

General Note: Changes in the following program categories reflect redefinition of project objectives (Information and Education Chief's office, Other).

PROVINCE: SASKATCHEWAN
1987—1988

PROGRAMS	SURVEY/ RESEARCH AGENCY	FUNDING AGENCY	NO. OF PROJECTS (OR FACILITIES)	SALARIES PERMANENT SMY	SALARIES CASUAL SMY	SALARIES PERMANENT $	SALARIES CASUAL/ TEMPORARY $	OPERATING EXPENDITURES $
Administration	SGS	SGS	1	4.0	—	170 000	—	24 000
* Core Repositories	SGS	SGS	1	6.0	1.3	103 800	23 000	46 700
Geochemical Surveys:								
(1) Bedrock	UofR	SGS	1	—	—	—	—	12 000
Geological Surveys, Bedrock:								
(1) Reconnaissance (1:100 000)	SGS	SGS	1	1.0	—	50 000	—	10 000
(2) Detailed (1:50 000)	SGS	SGS	1	4.0	4.0	145 000	72 000	144 000
Geological Surveys, Surficial	SRC	SRC	2	2.5	—	40 000	—	100 000
Geophysical Surveys	—	—	—	—	—	—	—	—
Hydrogeological Surveys	—	—	—	—	—	—	—	—
Information and Education	SGS	SGS	1	1.0	—	46 000	—	2 000
Laboratory Analysis Including Isotope Geology	SRC/UofR Carleton, etc.	SGS	3	—	—	—	—	18 000
	SRC	SRC	—	—	—	—	—	45 000
Mineral Deposit Inventory and Analysis Including Industrial Minerals	SGS	SGS	8	7.0	2.0	305 000	35 000	70 000
	SRC	SRC	8	3.5	—	101 000	—	100 000
Oil and Gas Inventory and Analysis	SGS	SGS	—	4.0	0.5	113 600	12 000	20 000
** Publications	SGS	SGS	—	6.0	—	289 150	—	101 900
*** Resident Geologist's Office	SGS	SGS	2	3.0	0.3	112 900	5 500	22 800
Subsurface (Stratigraphy) Studies	SGS	SGS	3	4.0	—	230 500	—	45 000
Water Resource Inventory and Analysis	SRC	SRC	6	4.3	—	193 000	—	130 000
Metallogenic Mineral Deposit Studies	SGS/UofR	SGS	7	1.0	0.5	57 000	15 000	34 000
	SRC	SRC	4	2.0	—	90 000	—	30 000
TOTALS	—	—	—	**53.3**	**8.6**	**2 046 950**	**162 500**	**955 400**
Grand Total	**$3 164 850**							

SGS — Saskatchewan Geological Survey
SRC — Saskatchewan Research Council
UofR — University of Regina
*Sedimentary rocks
**Includes cartography
***Includes igneous-metamorphic core storage

PROVINCE: **MANITOBA**
1987—1988

PROGRAMS	SURVEY/ RESEARCH AGENCY	FUNDING AGENCY	NO. OF PROJECTS (OR FACILITIES)	PERMANENT SMY	CASUAL/ TERM SMY	SALARIES PERMANENT $	SALARIES CASUAL $	OPERATING EXPENDITURES $	TOTALS $
Core Repositories	MM	MAN	4	1.01	0.48	40 300	19 700	38 000	98 000
Geochemical Surveys:									
(1) Bedrock	—	—	—	—	—	—	—	—	
(2) Drainage	—	—	—	—	—	—	—	—	
(3) Soil	MGS	MAN	1	1.00	.19	44 100	5 500	23 500	73 100
(4) Peat	—	—	—	—	—	—	—	—	
Geological Surveys, Bedrock:									
(1) Reconnaissance (1:100 000)	MGS	MAN	1	1.00	0.29	47 400	9 200	400	57 000
(2) Detailed (1:50 000)	MGS	MAN	14	9.00	2.11	447 900	56 800	108 800	613 500
(3) Phanerozoic	MGS	MAN	2	1.00	—	50 400	—	9 200	59 600
Geological Surveys, Surficial:									
(1) Raconnaissance (1:50 000)	—	—	—	—	—	—	—	—	—
(2) Detailed (1:50 000)	—	—	—	—	—	—	—	—	—
(3) Resource Management	—	—	—	—	—	—	—	—	—
Geophysical Surveys:									
(1) Airborne Electromagnetic	—	—	—	—	—	—	—	—	—
(2) Airborne Magnetic, Gradiometer	—	—	—	—	—	—	—	—	—
(3) Ground Magnetic	—	—	—	—	—	—	—	—	—
(4) Gravity	—	—	—	—	—	—	—	—	—
(5) Seismic	—	—	—	—	—	—	—	—	—
(6) Radiometric	—	—	—	—	—	—	—	—	—
(7) Remote Sensing	—	—	—	—	—	—	—	—	—
Hydrogeological Surveys	—	—	—	—	—	—	—	—	—
Information, Education, Assessment Services and Compilation	MGS/MM	MAN	8	5.00	1.36	210 000	51 900	69 400	331 300
Laboratory Analysis	MGS	MAN	3	10.40	2.30	364 300	52 900	65 700	482 900
Mineral Deposit Inventory and Analysis	MGS/UNIV	MAN	18	5.00	4.13	264 100	117 100	193 600[3]	574 800
Industrial Minerals	MGS	MAN	3	3.00	0.27	111 900	8 100	32 100	152 100
Oil and Gas Inventory and Analysis	—	—	—	—	—	—	—	—	—
Publications	MGS	MAN	36	—	—	—	—	29 300	29 300
Resident Geologist's Office	—	—	—	—	—	—	—	—	—
Subsurface Investigations, Industrial Mininerals Drilling and Management	MGS	MAN/GSC	1	.12	1.14	24 000	34 400	108 200[2]	166 600
Water Resource Inventory and Analysis	—	—	—	—	—	—	—	—	—
Other:									
(1) Administration	MGS	MAN	—	5.00	2.00	187 700	42 500	179 400[1]	409 600
(2) Drafting	MGS	MAN	—	10.00	2.20	350 600	56 100	24 300	431 000
(3) Uranium/Lead and Rubidium/Strontium Analyses	MGS/UNIV GSC	MAN	3	—	—	—	—	18 700	18 700
TOTALS	—	—	—	**52.01**	**18.39**	**2 142 700**	**454 200**	**900 600**	**3 497 500**

GSC — Geological Survey of Canada
MGS — Manitoba Geological Services Branch
MM — Manitoba Mines Branch
UNIV — Universities
MAN — Manitoba
[1]Includes 81.3 for Field Equipment and Capital
[2]Includes Winter Drill Project – GSC
[3]Includes U of M Agreements – 54.0

PROVINCE: ONTARIO
1967—1988

PROGRAMS	FUNDING AGENCY	NO. OF PROJECTS (OR FACILITIES)	MAN-YEARS PERMANENT	MAN-YEARS CASUAL	SALARIES PERMANENT $	SALARIES CASUAL $	OPERATING EXPENDITURES $	TOTALS $
Administration (Head Office)	MNDM	—	7	1	343.4	24.1	125.2	493.7
Core Repositories	MNDM	7	8	5	248.0	145.0	131.0	524.0
Geochemical Surveys/Research	—	—	—	—	—	—	—	—
Geophysical Surveys	MNDM	6	9	3	362.6	91.4	331.1	785.1
Airborne Electromagnetic	—	—	—	—	—	—	—	—
Gravity	—	—	—	—	—	—	—	—
Seismic	—	—	—	—	—	—	—	—
Geological Surveys:								
Precambrian	MNDM	16	23	16	1 059.9	430.2	492.3	1 982.4
Geological Surveys:								
Phanerozoic	—	—	—	—	—	—	—	—
Quaternary	MNDM	10	16	9	651.2	245.5	208.0	1 104.7
Aggregate	—	—	—	—	—	—	—	—
Geoservices:								
Publications	MNDM	—	15	6	491.9	182.8	499.1	1 173.8
Laboratory Analysis	—	—	22	4	766.8	99.8	557.0	1 423.6
Assessment Services	—	—	—	—	—	—	—	—
Equipment, Vehicles	—	—	—	—	—	—	—	—
Information, Education, Library	MNDM	—	16	7	520.0	214.6	975.1	1 709.7
Mineral Deposits Studies Including Industrial Minerals	MNDM	12	9	6	400.4	163.3	249.0	812.7
Resident Geologist's Offices	—	—	—	—	—	—	—	—
Geoscience Research Grants Program	MNDM	26	—	—	—	—	500.0	500.0
Geological Research Grants	MNDM	6	—	—	—	—	500.0	500.0
COMDA	CAN/ONT	61	—	96	—	2 677.0	1 853.0	4 530.0
Other Projects	MNDM	7	—	15	—	438.0	2 144.8	2 582.8
TOTALS	—	—	125	168	4 844.2	4 711.7	8 565.6	18 122.5

MNDM — Ministry of Northern Development and Mines
COMDA — Canada–Ontario 1985 Mineral Development Subsidiary Agreement

PROVINCE: QUÉBEC
1967—1968

PROGRAMMES	MAÎTRE D'OEUVRE	FINANCEMENT	NOMBRE DE PROJETS OU D'INSTALLATIONS	EMPLOYÉS PERMANENTS PERS.-ANNÉE (P-T-C-)**	EMPLOYÉS OCCASIONNELS PERS.-ANNÉE	BUDGET ALLOUÉ*** $
Levés géologiques	DGEGM	MER/EMR*	—	13P-3C	43	—
(1) Côte-Nord et Nouveau-Québec	—	—	10	—	—	2 208 800
(2) Sud du Québec	—	—	3	—	—	1 606 000
(3) Nord-Ouest du Québec	—	—	19	—	—	2 832 100
(4) Minéraux industriels	—	—	10	—	—	453 000
Levés géochimiques (au Québec)	DGEGM	MER/EMR*	17	3P-1T-1C	6	1 914 000
Levés géophysiques (au Québec)	DGEGM	MER/EMR*	12	3P-1T	—	1 000 000
Opérations (équipements de terrain, informatique, etc.)	DGEGM	MER	—	2P-3T	12	1 976 900
Assistance financière:						
(1) Programme ad hoc	DGEGM	MER	2	1P-1T-1C	4	2 576 800
(2) Gaspésie et Bas-Saint-Laurent	DGEGM	MER/EMR*	27	—	—	1 110 000
(3) Promotion	DGEGM	MERC	—	1P	—	289 900
Géoinformation	DGEGM	MER/EMR ET MER	—	13P-19T-10C	8	4 209 300
Bureaux des géologues résidents	DGEGM	MER	7	7P-4T-9C	4	1 358 800
TOTAUX	—	—	—	**43P-29T-24C**	**77**	**20 815 600**

* Entente auxiliaire Canada–Québec sur le développement minéral
** P — Professionnel
T — Technicien
C — Clérical
*** Excluant le salaire des employés permanents

PROVINCE: NEW BRUNSWICK
1987—1988

PROGRAMS	SURVEY/ RESEARCH AGENCY	FUNDING AGENCY	NO. OF PROJECTS (OR FACILITIES)	STAFF-YEARS PERMANENT	STAFF-YEARS CONTINUING AUXILIARY	STAFF-YEARS SUMMER AUXILIARY	SALARIES PERMANENT $	SALARIES CONTINUING AUXILIARY $	SUMMER AUXILIARY $	OPERATING EXPENDITURES $
Core Repositories	GSB	DNRE	5	1	—	0.25	41 000	—	3 000	12 600
Geochemical Surveys:										
(1) Bedrock	—	—	3	—	4	1.0	—	74 000	12 000	130 000
(2) Drainage	GSB	DNRE	1	—	—	—	—	—	—	50 000
(3) Soil	—	—	—	—	—	—	—	—	—	—
Geological Surveys, Bedrock:										
(1) Reconnaissance (1:100 000)	—	—	—	—	—	—	—	—	—	—
(2) Detailed (1:20 000)	GSB	DNRE	2	2	3	2.0	160 000	93 000	21 000	295 000
Geological Surveys, Surficial:										
(1) Reconnaissance (1:100 000)	—	—	—	—	—	—	—	—	—	—
(2) Detailed (1:50 000)	—	—	2	—	1	1.5	—	38 000	15 000	32 000
Geophysical Surveys:										
(1) Airborne Electromagnetic	—	—	—	—	—	—	—	—	—	—
(2) Airborne Magnetic	—	—	—	—	—	—	—	—	—	—
(3) Ground Magnetic	—	—	—	—	—	—	—	—	—	—
(4) Gravity	—	—	—	—	—	—	—	—	—	—
(5) Seismic	—	—	—	—	—	—	—	—	—	—
(6) Radiometric	—	—	—	—	—	—	—	—	—	—
Hydrogeological Surveys	—	—	—	—	—	—	—	—	—	—
Information and Education	GSB	DNRE	2	3	—	0.25	85 000	—	—	12 000
Laboratory Analysis	GSB	DNRE	1	2	—	0.25	54 000	—	3 000	13 000
Metallic-Mineral Deposit Inventory and Analysis	MDB	—	2	1	2	0.25	41 000	70 000	3 000	34 000
Industrial Minerals:										
(1) Evaporites	MDB	DNRE	1	0.5	—	—	20 500	—	—	7 500
(2) Limestone	MDB	DNRE	1	0.5	—	—	20 500	—	—	7 500
(3) Granular Resources	MDB	DNRE	2	2	—	0.25	65 000	—	3 000	10 000
Coal Inventory and Analysis	—	—	1	1	—	—	35 000	—	—	10 000
Oil and Gas–Oil Shale Inventory and Analysis	MDB	DNRE	1	1	—	—	41 000	—	—	10 000
Publications	GSB	DNRE	1	4	2	—	90 000	55 000	—	12 000
Resident Geologist's Office	GSB	DNRE	2	5	—	0.5	120 000	—	6 000	158 000
Subsurface Investigations	—	—	—	—	—	—	—	—	—	—
Peat Inventory	MDB	DNRE	1	1	—	0.25	41 000	—	3 000	10 000
Water Resource Inventory and Analysis	—	—	—	—	—	—	—	—	—	—
Other Studies*	GSB	DNRE	1	—	—	—	—	100 000	—	190 000
TOTALS	—	—	**34**	**25**	**12**	**6.5**	**814 000**	**430 000**	**69 000**	**993 600**

Grand Total **$2 306 600**

GSB — Geological Surveys Branch
MDB — Mineral Development Branch
DNRE — Department of Natural Resources and Energy
*Includes mineral economic, and mining studies and various research projects supported by GSB

PROVINCE: NOVA SCOTIA
1987—1988

PROGRAMS	SURVEY RESEARCH AGENCY	FUNDING AGENCY	NO. OF PROJECTS (OR FACILITIES)	PERMANENT STAFF MAN-YEARS	CASUAL STAFF MAN-YEARS	BUDGET ALLOCATIONS $
Core Repositories	NSDME	NSDME NSDOD	3	3	1	356 300
Geochemical Surveys:	NSDME	NSDME NSDOD	2	1	1	80 100
(1) Bedrock	—	—	—	—	—	—
(2) Drainage	—	—	—	—	—	—
(3) Soil	—	—	—	—	—	—
Geological Surveys, Bedrock:	—	—	—	—	—	—
(1) Reconnaissance (>1:100 000)	—	—	—	—	—	—
(2) Detailed (>1:50 000)	NSDME	NSDME NSDOD	3	3	8	682 200
Geological Surveys, Surficial:						
(1) Reconnaissance (>1:100 000)	—	—	—	—	—	—
(2) Detailed (>1:50 000)	NSDME	NSDME NSDOD	2	1	5	320 500
Geophysical Surveys:						
(1) Airborne Radiometrics	—	—	—	—	—	—
(2) Airborne Magnetic (includes VLF-EM)	—	—	—	—	—	—
(3) Ground Magnetic	—	—	—	—	—	—
(4) Gravity	—	—	—	—	—	—
(5) Seismic	—	—	—	—	—	—
Hydrogeological Surveys	—	—	—	—	—	—
Information and Education	NSDME	NSDME NSDOD	2	2	2	443 800
Laboratory Analysis	—	—	2	—	—	—
Mineral Deposit and Analysis	NSDME	NSDME NSDOD	9	4	6	1 424 000
Mineral Deposit Inventory	NSDME	NSDME NSDOD	3	3	2	129 700
Coal and Peat	NSDME	NSDME NSDOD	3	7	2	292 900
Oil and Gas Inventory and Analysis	NSDME	NSDME	2	5	—	523 400
Publications	NSDME	NSDME NSDOD	N/A	3	7	421 100
Resident Geologist's Office	NSDME	NSDME	N/A	15	—	213 500
Subsurface Investigations	NSDME	NSDME	N/A	4	6	643 900
Grants for Mineral Development (MISP)	—	—	N/A	—	1	115 500
TOTALS	—	—	**31**	**51**	**41**	**5 646 900**

NSDME — Nova Scotia Department of Mines and Energy
NSDOD — Nova Scotia Department of Development

PROVINCE: NEWFOUNDLAND
1987—1988

PROGRAMS	SURVEY/ RESEARCH AGENCY	FUNDING AGENCY	NO. OF PROJECTS (OR FACILITIES)	PERMANENT[1] SMY	CASUAL SMY	SALARIES PERMANENT $	SALARIES CONTRACT[1] $	CASUAL $	OPERATING EXPENDITURES $
Director's Office	NDM	NDM	4	8	2	167 095	57 774	7 781	100 042
Core Repositories	NDM	NDM	1	2	2	47 100	35 700	7 979	27 034
Geochemical Surveys:									
(1) Bedrock	—	—	—	—	—	—	—	—	—
(2) Drainage	NDM	NDM	4	4	3	133 480	48 064	10 676	119 466
(3) Soil	—	—	—	—	—	—	—	—	—
Geological Surveys, Bedrock:									
(1) Reconnaissance (>1:100 000)	NDM	NDM/ DEMR	8	9	18	189 253	144 056	112 058	579 308
(2) Detailed (>1:50 000)	NDM	NDM DEMR	10	8	7	194 247	213 552	27 878	337 653
Geological Surveys, Surficial:									
(1) Reconnaissance (>1:100 000)	—	—	—	—	—	—	—	—	—
(2) Detailed (>1:50 000)	NDM	NDM	4	6	6	50 629	170 464	34 083	214 382
Geophysical Surveys:									
(1) Airborne Electromagnetic	—	—	—	—	—	—	—	—	—
(2) Airborne Magnetic	—	—	—	—	—	—	—	—	—
(3) Ground Magnetic	NDM	NDM	1	1	1	—	35 851	5 974	30 391
(4) Gravity	—	—	—	—	—	—	—	—	—
(5) Seismic	—	—	—	—	—	—	—	—	—
(6) Radiometric	—	—	—	—	—	—	—	—	—
Hydrogeological Surveys	—	—	—	—	—	—	—	—	—
Information and Education	NDM	NDM	5	9	—	123 428	133 928	—	320 369
Laboratory Analysis	NDM	NDM/ DEMR	3	13	2	178 517	157 389	8 183	203 554
Mineral Deposit Inventory and Analysis	NDM	NDM/ DEMR	12	16	8	206 265	365 787	40 523	249 949
Publications	NDM	NDM/ DEMR	3	9	—	171 332	113 096	—	128 336
Resident Geologist's Office	—	—	—	—	—	—	—	—	—
Subsurface Investigations	—	—	—	—	—	—	—	—	—
Water Resource Inventory and Analysis	—	—	—	—	—	—	—	—	—
Other	—	—	—	—	—	—	—	—	—
TOTALS	—	—	55	85	49	1 461 346	1 475 661	255 135	2 310 684
Grand Total	5 502 826								

[1]Includes long term temporary staff
NDM — Newfoundland Department of Mines
DEMR — Department of Energy, Mines and Resources, Canada

TERRITORY: NORTHWEST TERRITORIES
1987—1988

PROGRAMS	SURVEY/ RESEARCH AGENCY	FUNDING AGENCY	NO. OF PROJECTS (OR FACILITIES)	SALARIES				OPERATING EXPENDITURES $
				PERMANENT SMY	CASUAL SMY	PERMANENT $	CASUAL/ TEMPORARY $	
Head Office (Administration, General Support)	INA	INA	1	4.7	—	235	—	135.4
Head Office (Administration, General Support)	MDA	MDA	1	—	0.3	—	12.0	39.8
Core Repositories	INA	INA	1	0.3	0.3	18	7.0	8.0
Geochemical Surveys:								
(1) Bedrock	INA	INA	1	0.1	—	5	—	3.0
Geological Surveys; Bedrock Surficial:								
(1) Reconnaissance (1:100 000)	INA	INA	1	0.2	—	10	—	8.0
(2a) Detailed (1:50 000)	INA	INA	8	1.5	3.5	75	60.0	175.0
(2b) Detailed (1:50 000)	MDA	MDA	—	—	—	—	—	49.2
(3) Surficial	INA	INA	1	—	0.2	—	5.0	8.0
Education	INA	INA	—	0.2	0.1	10	2.0	8.0
Laboratory Analysis	INA	INA	—	0.1	—	5	—	10.0
Mineral Deposit Inventory and Analysis	INA	INA	7	—	2.0	100	—	133.7
Mineral Deposit Inventory and Analysis	MDA	MDA	2	—	0.25	—	16.4	16.4
Publications	INA	INA	21	2.7	0.5	171	10.0	20.0
Other:								
(1) Prospectors' Assistance	INA	INA	—	0.2	—	10	—	5.0
(2) Geological Contracts	INA	INA	8	0.2	—	10	—	60.0
MDA Contracts	MDA	MDA	4	—	—	—	—	60.0
INA Totals	—	INA	N/A	12.2	4.6	649	84.0	574,100
MDA Totals	—	MDA	N/A	—	0.55	—	28.4	165,400
Grand Totals	—	—	N/A	12.2	5.15	649	112.4	739,500

INA — Indian and Northern Affairs, Canada
MDA — Mineral Development Agreement (Canada–NWT Government)
N/A — Not Applicable

TERRITORY: YUKON
1987—1988

PROGRAMS	SURVEY/ RESEARCH AGENCY	FUNDING AGENCY	NO. OF PROJECTS (OR FACILITIES)	PERMANENT SMY	CASUAL SMY	SALARIES PERMANENT $	SALARIES CASUAL/ TEMPORARY $	OPERATING EXPENDITURES $
Head Office (Administration, General Support)	INA	INA	1.0	3.0	—	115 000	—	133 000
Core Repositories	INA	INA	1.0	—	0.75	—	22 400	12 000
Geochemical Surveys:								
(1) Drainage	EMR INA	EMR/EDA INA	3.5	—	—	—	—	541 000
Geological Surveys Bedrock:								
(1) Detailed (1:50 000)	INA	EDA	2.0	—	4.0	—	120 000	127 000
Geological Surveys, Surficial:	INA	INA	3.0	0.5	0.5	29 000	23 000	43 000
Education	INA	INA	1.0	—	—	—	—	14 000
Laboratory Analysis	INA	INA/EDA	2.0	—	—	—	—	12 000
Mineral Deposit Inventory and Analysis	INA	INA	11.0	3.5	1.5	167 000	50 000	89 000
Publications	INA	INA	3.0	—	0.75	—	22 400	26 000
TOTALS	—	—	**27.5**	**7.0**	**7.5**	**311 000**	**237 800**	**997 000**

INA — Indian and Northern Affairs Canada
EDA — Canada — Yukon Economic Development Agreement
EMR — Energy, Mines and Resources Canada

GEOLOGICAL PROGRAM HIGHLIGHTS

PROVINCIAL AND TERRITORIAL GEOLOGICAL SURVEYS 1987-1988

BRITISH COLUMBIA MINISTRY OF ENERGY, MINES AND PETROLEUM

BRITISH COLUMBIA GEOLOGICAL SURVEY

INTRODUCTION

The British Columbia Geological Survey is one of four branches in the Mineral Resources Division. Its mission is:

> To aid and stimulate the growth of the mining industry for the social and economic benefit of the people of British Columbia by conducting geoscientific surveys and by inventorying and analysing the geology and mineral deposits of the Province

A sister branch in the Petroleum Division is responsible for the geological assessment of oil and gas resources situated onshore and offshore British Columbia.

In 1988, the Branch continued its recent remarkable growth. The budget was increased for the second year in a row (by $2 million in 1987 and by an additional $1.5 million in 1988) for a total Geological Survey budget of $6.7 million. The Government is sending a clear message to the mining industry that it is committed to providing a first class geoscience data base to encourage exploration and mine development in British Columbia. Most of the new money was spent on 1:50 000 scale geological mapping in poorly known and underexplored parts of the Province. Maps of this scale have been identified by industry as the fundamental underpinning for exploration work.

In addition, the Branch is responsible for delivering most of the geological programs under the Canada — B.C. Mineral Development Agreement (MDA). 1988 was the third of four field seasons under this Agreement, which provided $1.6 million to the budget for geoscience field work.

Branch publication sales are no longer being handled by the Ministry as a result of the ongoing Government restructuring and privatization. Bulletins and papers are now being sold by a private firm, Crown Publications, and maps and open files by a centralized government agency, Maps B.C.

The highlights of 1988-89 were:

- Record spending on geological surveys, supporting 32 provincial field projects and 10 MDA field projects.

- 10 parties now involved in regional 1:50 000 scale mapping.

- Research by Branch geochemists, Paul Matysek, John Gravel, and Steve Day, has shown that mosses, which are so prolific in B.C., act as a «golden fleece» for capturing gold in streams. Analysis of entrapped –80 mesh sediments has shown that the chance of detecting gold mineralization is much greater in moss samples than through conventional sampling methods.

- Successful delivery of the 1987-88 regional geochemical survey program, including for the first time, in-house map production.

  The 1988 release covering the northwest part of the Province sparked considerable activity.

- Appointment of a full-time geological editor, Brian Grant, to handle the record number of publications being generated by Geological Survey staff.

- Closure of the District Geologist offices in Fort St. John and Fernie after 10 years of service, due to Ministry staffing priorities and the low demand for services in the coalfields. David Grieve, the Fernie District Geologist, was transferred to Victoria to strengthen the Coal Subsection.

- Redesign of MINFILE — the Province's mineral inventory data base — was completed; to date, MINFILE data for twelve 1:250 000 scale NTS map sheets have been released to the industry. A PC-based search program to query the data base was written, in dBase III, and released as freeware to clients who purchase the resource inventory.

- The Branch's largest (1100 attendees) and most successful open house for industry was held in Vancouver in February 1988, in conjunction with the annual Cordilleran Roundup of the B.C. and Yukon Chamber of Mines.

- Branch geologists organized and led a successful five-day field trip for the Society of Economic Geologists on major gold-silver deposits of the northern Canadian Cordillera.

PROGRAM HIGHLIGHTS 1988-89

Mineral Deposits

This program continued to focus on precious metal mineral districts but each project addressed a broader mandate, namely identification and assessment of all mineralized environments within the study areas.

Neil Church completed mineral deposit, fracture analyses, and metal zoning studies in the historic Bridge River Camp. Andre Panteleyev completed his contribution to the Decade of North American Geology (DNAG) volume and spent a shortened field season completing the field component of geologic, and gold and copper-gold mineral deposits, studies in the Quesnel area. Dani Alldrick headed our largest field crew, mapping westward from the complex, Sulphurets gold camp. Trygve Hoy expanded work begun last year in the Rossland — Ymir districts. His recognition of strata-bound gold-skarn mineralization in the old Second Relief mine has sparked considerable interest. Gerry Ray is completing research leading to publication of bulletins summarizing mineralization in the Coquihalla belt, and work done in the Hedley gold skarn camp. Together with Art Ettlinger, he completed a major compilation of precious metal enriched skarn deposits in British Columbia. This paper is currently in press.

Metallogenic studies of mafic and ultramafic rocks continued in an MDA-funded project led by Graham Nixon. Alaskan-type complexes were mapped and sampled in the Turnagain, Gnat Lakes, Mount Hickman, Menard Creek and Polaris mafic-ultramafic complexes, to assess PGE and other mineral potential.

Tom Schroeter continued his investigations of major gold deposits in British Columbia.

W.J. McMillan presented regional geochemical and metallogenic analyses and syntheses in a number of workshops and scientific meetings.

Regional Mapping

The Geological Survey Branch initiated a systematic, regional, 1:50 000 scale, geological mapping program in 1985. This MDA-funded program was expanded from four to seven projects in 1987, with the additional funding coming from the province. In 1988, the program was further enhanced by the province and three more mapping projects were started — two in the Stikine River area (Logan and Brown) and one in the Atlin district (Bloodgood).

Nick Massey's MDA-funded Sicker Project, started in 1986, is now complete. His work has helped refine the stratigraphy of the Paleozoic Sicker Group, an important host for polymetallic massive sulphide deposits of the Westmin-type. New target areas have been delineated as a result of this mapping.

Joanne Nelson has been mapping in the Midway — Cassiar area since 1986, under the MDA. She has shown that the Sylvester allochthon, which contains a dismembered ophiolite sequence, formed in a marginal basin setting not far removed from ancestral North America. High angle, post-compression fault sets in the area control the distribution of epigenetic vein deposits.

In the Whitesail Lake area, MDA-supported mapping by Larry Diakow has resulted in a better understanding of Jurassic, Cretaceous and Tertiary stratigraphic relations. Of particular significance is the delineation of favourable metallotects for precious metal vein deposits.

Farther south, in the Taseko Lakes area, Keith Glover and new project leader, Paul Schiarizza, have refined the tectonic and stratigraphic relations between the Bridge River terrane and younger, Mesozoic rocks. This MDA project has resulted in a clearer understanding of the tectonic history of the area — an important piece in the B.C. tectonic puzzle.

In the Manson Creek — Germansen Lake area, Filippo Ferri completed a second year of mapping, focussing on the Takla — Slide Mountain — Ingenika — Wolverine Complex terrane boundaries. This project has resulted in further subdivision of the Slide Mountain and Takla groups. The map area is an old placer gold camp, with potential for lode gold deposits.

Two new mapping projects were started north of the Iskut River. Jim Logan and Derek Brown, project leaders for the Telegraph and Stikine projects respectively, focussed on resolving the stratigraphic and structural setting of the Paleozoic Stikine assemblage and overlying Triassic volcanic rocks. The map area covers part of a belt of syenitic intrusions, east of the Coast Plutonic Complex, that has been the site of active gold exploration.

Mitch Mihalynuk continued mapping and geochemical sampling in the Tutshi — Tagish lakes area, where a number of fault controlled gold occurrences are being actively explored as a result of work done in 1987. Mitch and his crew have refined the regional stratigraphy and structure with the recognition of a profound unconformity separating the Paleozoic Nisling Terrane from younger, Mesozoic strata.

A new mapping project, with Mary Anne Bloodgood as project leader, was started in the Atlin Placer Gold Camp. In this area the placer deposits are spatially associated with fault zones that cut ultramafic and altered volcanic rocks of the Cache Creek Terrane. Recently, lode gold occurrences have been discovered associated with listwanites in major fault zones and these have been the focus of considerable exploration activity.

Don MacIntyre and Pat Desjardins completed mapping in the Babine Range and have moved westward into the Telkwa River valley. This work has resulted in a better understanding of the Lower to Middle Jurassic stratigraphy of the Telkwa, Nilkitkwa and Smithers formations. The bimodal volcanic rocks of the Nilkitkwa Formation are favourable hosts for gold and silver-bearing quartz veins.

Applied Geochemistry

Data released in July, from samples collected in 1987, from the Iskut River, Sumdum, Telegraph Creek and Tulsequah map sheets in northwestern B.C., sparked considerable exploration interest and activity. Ninety data sets were sold on release day; to date, sales total 120 sets and 30 floppy diskettes.

The 1988 sampling crews collected from 2746 sites on northern Vancouver Island. This included 1657 moss mat sediment samples; moss was selected as the best medium after the 1987 orientation surveys.

Orientation surveys were conducted on southern Vancouver Island, the adjacent mainland, and in the Bowser Basin of north central B.C. Research continued into improved use of analytical results and seasonal changes in geochemical responses.

District Geologists

In 1988, the number of District Geologists decreased from seven to five, due to one early retirement and internal reorganization. The major responsibilities of District Geologists continue to be providing timely and informal advice to the Ministry's Mine Development Review Process; maintaining an up-to-date inventory of the geology, mineral deposits, exploration trends and developments in the various districts; providing advice to industry, prospectors and the public; and providing training for prospectors.

Mineral exploration in British Columbia has been at record levels in 1987 and 1988, and the District Geologists undertook field studies in selected «hot» exploration camps such as the Stewart and Iskut gold belts, the Okanagan, the Sicker Belt on Vancouver Island, the Bralorne Camp and others.

Coal Resources

Fieldwork in the Province's coalfields decreased in 1988, due to the conclusion of several major projects: Elk Valley Coalfield (Dave Grieve), Tonstein and Vitrinite Reflectance projects (Ward Kilby), and Bowser Basin (Jahak Koo). Candace Kenyon carried out regional mapping, correlation, and coal rank studies on the Vancouver Island coalfields. Alex Matheson launched a pilot study of small-diameter drilling to obtain fresh, unoxidized coal samples in unexplored areas, to determine coal rank.

In addition to field studies, the subsection maintains a file of coal exploration data submitted under the Coal Act. A computer-based inventory system, COALFILE, provides rapid summary and indexing facilities to complement the hard copy file. A library of coal core is maintained at the Ministry's Charlie Lake facility. A valuable research and reference source for the coal industry is provided by 150 000 m of core from some 525 representative boreholes.

Digital deposit modelling and coal quality projects were initiated in 1987. Our analysis of the Monkman deposit has resulted in structural simplification and potential tonnage increases in the proposed pit areas. Analysis of the Mt. Klappan deposit is in progress. A compilation of the coal quality specifications of B.C.'s coal deposits is nearing completion and results will be published early in 1989. A detailed study of beneficial and detrimental components of the Province's coal resources was initiated in 1988.

Industrial Minerals

A major program to inventory industrial mineral resources of the Province continued in 1988 with field studies on several commodities: gypsum resource inventory (Steve Butrenchuk), wollastonite potential (Gary White), and fluorspar potential (Jennifer Pell). Following the Branch's discovery in 1987 of a major zeolite occurrence and a number of potential sources of natural pozzolan and perlite in the interior Tertiary basins, this project was expanded in 1988. Kim Green studied the area around Gang Ranch, and Geotex Consultants surveyed the area north of Kamloops.

A field study of a newly discovered yttrium-bearing carbonatite complex on the Kechika River was conducted by J. Pell.

Jill Thompson completed an office-based compilation study of elemental sulphur occurrences in Devonian evaporite and reef units in northeastern B.C. Oil and gas well logs, provided by industry, were the major data source for the research.

An impressive number of industrial mineral publications were released this year, including an aggregate inventory of the B.C. mainland (D. Hora), kyanite and garnet potential (J. Pell), talc occurrences (M. MacLean), magnetite potential (K. Hancock), dimension stone (G. White and D. Hora), and peat inventory (D. Meynard).

University Geoscience Research

The Branch's Geoscience Research Grant Program was continued and expanded in 1988. Twenty-seven grants, totalling $130 000, were awarded to individuals at 10 universities, in support of research on the geology and mineral deposits of the Province. In addition, the MDA contributed $60 000 to The University of British Columbia in support of II research projects. Results of these research programs are published in «Geological Fieldwork».

Financial Assistance for Mineral Exploration (FAME)

The FAME program was renewed in 1988, with support for the Prospectors Assistance Program. The $500 000 funding enabled 137 grants to be awarded to individual prospectors to help them in their search for the mines of tomorrow.

This program also supports prospector training courses, and free advice and consultation in the field.

The 12th Annual Advanced Prospecting Course was delivered April 20 to May 7, 1988, at the Cowichan Lake Forest Research Station on Vancouver Island. A full class of 32 students received instruction from the Branch's District Geologists and from industry specialists. This is generally recognized as the best prospecting course in Canada, if not in the world.

ALBERTA RESEARCH COUNCIL

INTRODUCTION

Two Alberta Research Council departments are involved in geological research: the Alberta Geological Survey (Basin Analysis, Oil Sands Geology, Coal Geology and Mineral Resources groups) and the Terrain Sciences Department (Quaternary and Environmental Geology Group). This highlights article summarizes the geological survey related activities of both departments. Much of this work is funded jointly with government departments and provincial agencies, whereas some projects are carried out under contract to industry or government. Further information regarding geological survey activities in Alberta can be obtained by reference to the publications list or the Annual Report of the Alberta Geological Survey.

1988 saw a number of changes in the Alberta Geological Survey in terms both of staff and of interaction with our client community. We developed a business plan, one thrust of which calls for closer links with our clients. A strategic planning and business development co-ordinator was appointed, we started a program of visits to industry, and a brochure was prepared to inform potential clients and the general public of our capabilities. Our external Technical Advisory Committee, consisting of representatives from industry, academia and government, plays an important role in the development of our plans for the future.

The Alberta Geological Survey, in close co-operation with the Alberta Chamber of Resources, also gave strong logistical support to the Alberta Department of Energy in its negotiations towards a Mineral Development Agreement with the Government of Canada.

During 1988, the Alberta Geological Survey continued to provide information and expertise that supports government in its management of the province's earth resources and that helps industry exploit these resources.

BASIN ANALYSIS

The Basin Analysis Group is a multidisciplinary team with expertise in various aspects of basin analysis including stratigraphy, sedimentology, hydrogeology, geothermics, geochemistry, numerical modelling of transport processes in porous media, and software development for handling large data bases. The main research and development thrusts are related to deep waste disposal and petroleum exploration.

The Group has gained considerable experience in deep waste disposal in Alberta through contracts with provincial and federal government departments and agencies, as well as with the private sector. Detailed evaluations of the stratigraphic and sedimentological sequences, hydrogeological and geothermal regimes, and formation fluid geochemistry, have been carried out in the Cold Lake, Swan Hills, Peace River Arch and Beaufort-Mackenzie regions of Canada. The compilation of a new «Geological Atlas of the Western Canada Sedimentary Basin» is also directed and managed by the Group.

The integrated, multidisciplinary approach developed by the Basin Analysis Group is available through contracts, for assistance in the solution of various waste disposal and petroleum exploration problems.

OIL SANDS GEOLOGY

During 1988 the Oil Sands Geology Program had three broad objectives:

- to continue the long term, large scale regional resource characterization and assessment studies of the major oil sands deposits;

- to refine and evaluate applications of the finer scale, detailed reservoir analysis technology initiated during the previous reporting period;

- and to continue to integrate the insight and expertise developed from these survey and research activities into applied technical support for the thermal pilot projects in which the Alberta Oil Sands Technology and Research Authority (AOSTRA) is a technical and financial partner.

As has been the pattern for the past several years, these objectives were met primarily through three research programs. The largest of these is the Joint Oil Sands Geology program, funded on an equal, tripartite basis by the Alberta Research Council, the Alberta Department of Energy, and the Alberta Oil Sands Technology and Research Authority. Within this program there are two major technical projects: Resource Characterization, focussed on the central portion of the Athabasca deposit and on some mineralogical concerns associated with the Clearwater Formation in the northern Cold Lake deposit; and Reservoir Analysis, oriented towards the development and application of techniques of multidisciplinary reservoir modelling.

The second major research program, funded entirely by AOSTRA, is the Strategic Geology Program. Geological support for AOSTRA's Underground Test Facility (UTF) is the main priority, and the opportunity exists for an unparalleled examination of reservoir characteristics and response to thermal stimulation. Smaller scale activities have resulted in the completion of a study on the Peace River deposit to identify areas amenable to a particular recovery process, and in a preliminary evaluation of the application of computerized log analysis to the identification of mobile versus irreducible water.

The third program, although small from both a financial and manpower perspective, has been the continuing provision of geological technical support to AOSTRA and its industry partners in a number of thermal pilot-projects.

COAL GEOLOGY

The Coal Geology program has now almost completed a three year jointly funded program with the Alberta Department of Energy, looking at the distribution of coal quality attributes across the range of Alberta coals. Detailed coal facies studies in the plains, and sedimentology and structural studies in the mountains and foothills are well underway. This work is putting coal quality data into a geological framework in an attempt to create models that can predict coal quality variations. In addition, a user friendly, efficient, digital data base is being created and a Geoscience Information System demonstration is being prepared. A number of open file reports and technical papers based on this work have been published.

MINERAL RESOURCES

The Mineral Resources Group investigates the metallic and industrial mineral resources and the geology of Alberta. The Group records and stores data on mineral resources (including storage of drill core and mineral assessment reports), provides contract services, advice on enquiry, and disseminates information on the mineral resources of the province. In 1988 the Mineral Resources Group collected original data on kaolin, sand, gravel and raw materials for ceramics. The Group also reviewed, and published or presented, information on phosphate, platinum group elements and Alberta's metallic mineral potential.

TERRAIN SCIENCES DEPARTMENT
QUATERNARY AND ENVIRONMENTAL GEOLOGY

Like the Alberta Geological Survey, the Terrain Sciences Department forms part of the Natural Resources Division of the Alberta Research Council. It provides input to geoscience research in Alberta and includes a multidisciplinary team with expertise in Quaternary and surficial geology, glaciotectonic terrain, geostatistics, geotechnical engineering, coal mine reclamation, hydrogeology, soil science, erosion, drilling-waste disposal, geographic information systems, digital modelling, and simulation modelling. Research by the Quaternary Geology Group complements that of the Alberta Geological Survey.

Current contributions to Alberta geology by this group have focussed on highwall stability problems in coal mines; recognition, structure and distribution of glacially thrust bedrock; application of surface and downhole geophysical techniques for plains coal mining; small and medium scale surficial mapping; and the development of the Quaternary stratigraphic framework in the Cold Lake oil sands and Lloydminster heavy oil areas.

SASKATCHEWAN DEPARTMENT OF ENERGY AND MINES

GEOLOGY AND MINES DIVISION

Introduction

The division is responsible for the maintenance of a geoscientific and mining data base for the department, and for the disposition of all Crown minerals other than petroleum and natural gas. Data are collected in two main ways: firstly, by division staff directly through geological mapping and other field surveys; and secondly, by means of industry exploration and production records made available under statute.

The primary objective of the division is to promote exploration and development opportunities in the petroleum and mineral sectors through publications, data files, core collections, symposia, open-house meetings, individual consultations, and by responding to direct inquiries from industry and the general public.

As part of the general downsizing of the Public Service in May, 1987, the Geological Survey Branch was eliminated, although the name «Saskatchewan Geological Survey» is retained to identify geoscientific activities of the division. In addition, operational funds for field activities were reduced about 20 percent from the previous year.

Assistance in program design and evaluation of program effectiveness continued to be provided by the Saskatchewan Geological Liaison Committee who met twice during the year. Committee members were R. Laine - Amok Canada Ltee. Chairman, H. Hendry - University of Saskatchewan, D. Kent - University of Regina, R. Arnold - Saskatchewan Research Council, P. Cooper - Saskatchewan Mining Association, and P. Gummer - Claude Resources Limited.

Precambrian Geology

Field projects continued to be funded under the five-year $6.38 million Canada-Saskatchewan Mineral Development Agreement (MDA) which was in its fourth year in fiscal 1987-88. The provincial component of the MDA includes geological mapping; geochemistry; isotope geology; and related mineral deposit studies, largely in the triangle of country between La Ronge, Reindeer Lake and Flin Flon. The four-year mapping program of the La Ronge Gold Belt was essentially completed at yearend and trace-element geochemical maps were prepared for the northern part of the belt. This is prime gold exploration terrain with one producing mine, the Star Lake Mine, and several other deposits in advanced stages of exploration and pre-development. Projects, supportive of the geoscience mapping program, including bedrock geochemistry and geochronology studies, were contracted out to, or joint ventured with, university personnel at the University of Regina, Carleton University and the University of Kansas, as in previous years.

Geoscience data base files and descriptions of rock sample collections are in the process of computerization (main frame and micro). A microcomputer data base was also initiated to catalogue geochronological determinations, and a Precambrian Lexicon database was further developed.

Petroleum Geology

The Well Information System was kept up-to-date with the addition of data from 2035 licensed wells (compared to 1411 in fiscal 1986-87) and four new cross sections were added to the southern Saskatchewan grid series.

Three major subsurface stratigraphic projects continued throughout the year: Geology of the Medicine Hat Sand (Cretaceous) in Southeastern Saskatchewan; Development of a Depositional Model for the Oil-Prone Jurassic Section in the Wapella-Moosomin Area, Southeastern Saskatchewan; and Geology of the Interlake Group (Silurian) in Saskatchewan.

The Subsurface Geological Laboratory is a repository for cores and cuttings from oil, potash and coal test holes. During the year 5882 boxes of core from 394 wells, and 30,708 vials of cuttings from 363 wells, were received and entered into the permanent collections. The examination facilities were used by 145 persons representing 82 companies and 6 other organizations; they made use of 34 375 boxes of core from 2,329 wells, and 10,560 vials of cuttings from 352 wells.

The Laboratory Warehouse Section personnel were reduced from six to four, and in order to handle the work load, the service of providing rock thin-sections was reduced to an «as time permits» basis.

Mineral Development

The major responsibility of the branch is evaluation of technical reports submitted under regulation by industry; and the maintenance of a geoscientific data base incorporating the historical exploration record and the results of geoscientific investigations carried out by staff geologists and other agencies. The branch also operates Resident Geologists' offices at La Ronge and Creighton, although the latter was reduced to part-time operation during the year due to budget restraint. In the current fiscal year over 1400 visitors were received at the Resident Geologists' offices. During the year, 1844 submissions for assessment credits were processed for claimed expenditures of $31.3 million. A total of 477 new assessment files were incorporated into the historical record. Work continued on computerization of the Saskatchewan Mineral Deposits Index, and on documentation of new occurrences.

Studies of metallic mineral deposits and their geological settings were funded under the MDA and implemented by branch staff, and through contracts with the universities of Regina and Saskatchewan. Gold deposit studies were undertaken in the Sulphide Lake area north of La Ronge, and work on a newly recognized type of polymetallic gold-platinum-uranium mineralization was initiated in the Goldfields area near Uranium City. In addition, a recently discovered alkalic intrusive complex in the Peter lake area was evaluated for its rare earth element potential.

The collection of mineralized core at La Ronge received additions totalling 5226.5 m from uranium deposits in the Athabasca Basin and from gold deposits in the La Ronge and Flin Flon areas.

The annual six-week Prospectors School in La Ronge was run by branch staff in co-operation with the La Ronge Community College; eight students graduated.

Industrial Minerals

The principal responsibilities of the section are to maintain technical data files on the industrial minerals of the province, and to provide an information service to industry, the general public, and other government departments and agencies. During the year, a total of 141 inquiries on technical, economic and regulatory aspects of industrial minerals were processed.

During the year, four major projects were in progress: compilation of potash mine geology and analytical data; work was initiated on the compilation of a coal data base; investigation of building stone resources, partly under MDA funding; and a new industrial minerals map of the province was near completion.

Geodata
This section maintains the manual and computerized well files, and the records of geophysical exploration for oil and gas, under the Oil and Gas Conservation Regulations. These files are the basis for service to industry, government agencies and the public, through direct consultation and the provision of copies of non-confidential information. During the year, 969 new wells were coded and entered into the system, as well as almost 3000 items of supplementary data. Demand for data retrieval continued at a high level: almost 24 000 files were made available for examination, approximately 25 000 pages of data were photocopied, and 600 geophysical maps were reproduced.

Cartographic and Editorial Support
This section handles the editing and production of all geoscientific reports and maps published by the division, and in addition, provides departmental drafting services. During the fiscal year, six publications were produced, comprising 695 pages and 22 maps.

Acquisition of a desk top publishing system with a laser printer, and a computer mapping system for petroleum development maps, will increase efficiency and help to maintain service to industry despite staff cuts.

SASKATCHEWAN RESEARCH COUNCIL

Metallogenic Studies
With the completion of studies of unconformity uranium deposits in the 1986-87 project year, the program has been reoriented toward other aspects of uranium development and exploration. A study was initiated to characterize the background geochemistry and mineralogy of the Athabasca Group. The results of this work will permit the detection of hydrothermal alteration associated with uranium mineralization in deep drilling across the Athabasca Basin.

A project has been initiated to characterize the major and minor element geochemistry of the Martin Formation in the Beaverlodge area, in co-operation with the University of Saskatchewan and the Saskatchewan Geological Survey. The purpose of the study is to detect alteration patters indicative of mineralization that may have been overlooked in previous surveys.

A project has been initiated to characterize felsic intrusions in the Waddy Lake area of the La Ronge-Wollaston Lake metavolcanic belt, in order to examine the relationship between gold mineralization and these intrusions.

Data Analysis
The development of image analysis methodologies for interpreting exploration data was continued. Application of the techniques to practical cases was impeded by the transfer of the Canada Centre for Remote Sensing system to another agency. The plan is to purchase the required equipment in 1988, and then commence the application of image analysis techniques through contracts with the exploration industry.

The application of data analysis techniques to a wide range of in-house projects is increasing as clients and researchers are demanding more sophisticated statistical treatment of research data.

Geochemical Services
The Geochemical Services Laboratory provides major and minor element analyses of ores, rocks, soils, lake sediments, and vegetation for both in-house projects and the mineral exploration

industry. Approximately 300 000 element determinations were performed on 30 000 samples during the year, double that of the previous year. The heavy mineral concentrating facility has gained enthusiastic acceptance with the exploration industry. A fire assay service has been initiated for gold and platinum group metals.

Quaternary Geology Studies
Quaternary geology mapping and sampling in areas of gold exploration was continued to provide companies with basic information about the history of deglaciation and the Quaternary deposits, so as to assist in the design and interpretation of till geochemistry surveys, Quaternary geology mapping and sampling in areas of gold exploration was continued. A report of the previous year's work at Sulphide and Hebden lakes in the La Ronge metavolcanic belt was completed. Several small contract studies were also completed for exploration companies.

The 1:250 000 scale National Topographic Series maps summarizing the surficial geology of the entire province have been completed, and the production of a 1:1 000 000 scale Quaternary map of the province has commenced.

Aggregate Resources Inventories
The compilation of aggregate resources information for rural municipalities continued. Aggregate resource information was compiled for more than 40 sites in four municipalities. The work is funded under the Canada-Saskatchewan Mineral Development Agreement, and by the Department of Rural Development.

Groundwater Studies
An investigation of groundwater processes continued near Saskatoon, with emphasis on flow in tills, age dating, aquifer hydraulics, and chemical processes. An MSc student from the University of Waterloo is assisting with the project. An investigation of alternative methods of producing computer-drawn groundwater and geology maps is continuing. The monitoring of groundwater levels at 50 sites in the province was continued for the 26th year. The study of potential pesticide contamination of groundwater in an area of intensive irrigation in the Outlook area, was completed with inconclusive results. Smaller groundwater projects completed included: a heat pump monitoring study, an assessment of the impact of disposing of oily wastes on rural roads, and monitoring subsurface brine migration at a Saskatchewan potash mine waste disposal facility.

Resource Processing Activities
Mineral resources projects undertaken for clients included: the completion of kaolin purification work, gold ore processing, Cigar Lake Mine water treatment studies, and processing of high-grade uranium ore. The Pipeline Development Centre undertook projects for clients studying the transport of Alberta coal in crude oil, water-oil emulsions, tar sands, and lignite slurries.

Rock Mechanics
The triaxial testing of large potash cores (20 cm diameter X 40 cm long) for Cominco Ltd. has been completed succcessfully. A two-year program of triaxial testing of about 30 potash cores from Saskatchewan mines has commenced. Rock mechanics instrumentation, designed and fabricated for both Saskatchewan and New Brunswick potash mines, included pressure transducers, stress cells, closure meters, gauge panels, and water-pressure monitoring devices.

Remote Sensing
Remote sensing projects undertaken for clients included an assessment of forestry leases, mapping a proposed uranium mine access road, assessing the effects of drought on agricultural regions, and lineament analysis for mineral exploration.

Petroleum Research
Research projects continued to be directed to heavy oil development. Studies underway included thermal studies of Saskatchewan heavy oil cores, pressure-volume-density studies of heavy oil with and without carbon dioxide, water-oil emulsion studies, evaluation of steam injection, miscible displacement, and in-situ combustion processes.

MANITOBA ENERGY AND MINES

GEOLOGICAL SERVICES BRANCH

The results of the 1987 field program were summarized in the Annual Report of Field Activities and 16 preliminary maps which were released at the Mineral Resources Division's Meeting with Industry in Winnipeg on November 23 and 24, 1987.

During the winter months, Manitoba Geological Services Branch (MGSB) and Geological Survey of Canada personnel gave six talks on various aspects of Mineral Development Agreement (MDA) work to northern branch meetings of the Canadian Institute of Mining and Metallurgy (CIM) in Lynn Lake, Thompson and Flin Flon.

For the balance of the winter, Provincial and Federal staff engaged in compilation and analysis of materials and data stemming from the previous field seasons, as well as report production and talks given at various technical seminars in Manitoba and across Canada.

MDA displays were also featured at the Geological Survey of Canada Forum in Ottawa (January 19 and 20, 1988).

From September to March, 1988 MGSB staff responded to over 375 enquiries on minerals related topics, in addition to other exchanges at the annual meeting in Winnipeg and 230 enquiries received at the Provincial display booth at the annual convention of the Prospectors and Developers Association in Toronto (March 6-9, 1988).

In 1988 the main thrust of provincial, Sector A geoscientific activities has been to conclude and document all investigations mounted over the previous four-year term of the Canada — Manitoba Mineral Development Agreement.

The joint federal-provincial workplan for Sector A was approved in March, and copies were distributed to members of the Mineral Exploration Liaison Committee. Briefing sessions were held in Winnipeg and several northern mining districts prior to the field season. A progress report for 1987-88 was released June 27, 1988.

The 35 projects mounted by the Province included 17 geological mapping, 13 mineral investigations, 4 compilation, and 1 basal till investigation. A modest level of field work was maintained in all mining districts with an operational budget of $744 500.

The majority of the 27 sub-projects and contracts carried out within the 20 federal (GSC) projects have had their field studies completed and emphasis is now being directed toward documenting and publishing the results. This work will include the completion of seven Masters and three Doctoral theses in 1988-89, and two MSc and one PhD in 1989-90. Federal operational expenditures for 1988-89 will be $1 131 000.

LYNN LAKE — LEAF RAPIDS
Geological mapping at 1:5000 and geological sampling along the Agassiz Metallotect continued this field season. High-magnesium volcanic rocks, a major component of the rocks within the Metallotect, were located at Arbour Lake, White Owl Lake and Barrington Lake.

In the Barrington Lake area the stratigraphy is consistent for approximately 5 km and is broadly similar to the stratigraphy of the Eagle Lake area, mapped in 1987.

Several mineral occurrences were examined in the Arbour Lake area. Banded magnetite iron formations were mapped and sampled near Jim Lake and Muskeg Lake.

Till sampling in the Darrol Lake area south of the Ruttan Mine revealed mainly background and abraded gold grains derived from extensive glacial erosion of volcanic and sedimentary rocks up-ice. Results from the Deep South Bay and Duval Lake areas were similar but do not rule out the potential for gold mineralization up-ice towards the Kisseynew gneiss belt.

Vegetation geochemical studies are proceeding in the Dot Lake area, and the results of the Farley Lake remote sensing study are to be released forthwith as an Open File report.

Analysis of samples of aegirine-augite and augite-bearing miaskitic alkaline intrusions at Eden and Brezden Lake confirmed the similarity of these bodies with that mapped at Burntwood Lake last year. Evidence of associated economic mineralization is not yet apparent.

FLIN FLON-SNOW LAKE

The Kisseynew Project mapping program was completed this year. Kississing Lake, Puffy Lake — Limestone Point Lake and Sherridon were mapped at 1:15 840 and compiled at 1:50 000. Revised names and relative ages have been suggested for the Sherridon and Nokomis Groups.

Mapping at Kississing Lake clarified the sequence of structural and metamorphic events, and confirmed previously inferred age relationships with aluminous graphite-bearing gneisses of the Burntwood Metamorphic Suite which underlies the younger, predominantly quartzofeldspathic rocks and gneissic conglomerates of the Missi Metamorphic Suite.

Geological mapping at 1:20 000 scale of the Tartan and Embury lakes areas traced faults and fault blocks defined in the White Lake — Flin Flon area north and west toward the Saskatchewan border, and showed that the Manistikwan — Bear Lake blocks can be clearly distinguished by the character of their mafic volcanic rocks. The proximity of Trout Lake Mine massive sulphide orebodies to a major fault indicates the possible economic significance of the faults in localizing the orebodies of this region.

Field work in the Athapapuskow project completed a three-year study of the area. The principal findings were: the demonstration of dextral movement on all northeast trending faults and shear zones in the eastern half of the area; identification of a very wide (1 km) east-northeast-trending zone of intense deformation in southern Athapapuskow Lake (possibly continuous into Elbow Lake); the resolution of nearly all faults in the area into a single, master structure corresponding to a southwest-trending magnetic linear detected in the sub-Paleozoic to the south; and the delineation of a major, relatively late, unfoliated pyroxenite-peridotite in the West Arm — Athapapuskow region. An unusually thick (3 km) section of scoria-rich mafic pyroclastic material was discovered high in the Hook Lake block stratigraphy.

Trace element geochemistry has defined two major subdivisions of the Amisk Group: rocks with arc tholeiite affinity, and basalts similar to those erupted in back-arc basins. A small but significant unit of volcaniclastic rocks contains clasts with shoshonite compositions, indicating a mature stage of arc development.

Samples collected from metavolcanic rocks in the Snow Lake (Chisel — Morgan lakes) area demonstrated a tholeiitic and island-arc chemistry matching that of the Flin Flon region. A distinctive REE and trace element chemistry was demonstrated for the footwall unit of the Chisel, Lost and Ghost Mine base-metal zone; a chemical distinction is apparent between the Richard Lake and Sneath Lake plutons.

Pyroxene samples from weakly metamorphosed volcanic rocks in the Hook Lake block were analyzed by microprobe to determine their minor element compositions, Mg:Fe ratio, and by inference, their tectonic affinity. Results thus far suggest that the primary magmas were sub-alkaline and that emplacement was in a tectonic environment similar to modern island arcs.

A six-week mapping program was conducted over the Big Island Zinc property east of Manistikwan Lake to define the stratigraphic setting of the mineralization, as well as the alteration and associated structure.

Detailed mapping to the north and west of that completed in 1987, continued to examine altered, folded felsic fragmental rocks in the Leo Lake-Flintoba Lake area. Mapping of the Baker — Patton alteration zone identified a westward younging sequence including several newly identified felsic units, andesite flows and breccias, and a diatreme breccia. The role of faulting has a special significance in the interpretation of previous drill hole intersections.

Mineral occurrence documentation was completed in NTS areas 63 J/12, 13, 63 K/16 and 63 O/4. Mapping of multi-element mineralization at Puella Bay, Wekusko Lake at 1:2500 scale was completed, and detailed maps were prepared for the vicinity of the Zona Occurrence.

Mapping projects at 1:5000 scale were completed in the Puffy Lake area and initiated at Squall Lake. The Main Zone of mineralization at Puffy Lake appears to be close to, or contiguous with, the axial trace of a prominent F2 fold.

Only some of the samples taken from the Moose-Horn, Ballast Mine, McCafferty vein and Ferro Mine in the Wekusko Lake area yielded anomalously high Pt, Au and Pd concentrations warranting further examination for PGEs.

An examination of base and precious metal mineral potential of the Herblet and Pulver gneiss dome complexes was initiated this summer. Numerous zones of disseminated pyrite, pyrrhotite and chalcopyrite were examined. Aerially extensive alteration zones were observed at Pulver Lake, and a zone of undetermined extent, containing 2 to5 percent disseminated chalcopyrite with associated anthophyllite-garnet alteration, was identified at Dowling Lake.

Humus geochemical studies were continued in the Snow Lake and Flin Flon areas, in association with Westfield Minerals and Hudson Bay Exploration and Development Ltd.

An U-Pb zircon age of 1889^{+6}_{-6} Ma on the Richard Lake tonalite is very close to the 1886 Ma age obtained for Amisk Group volcanism, supporting previous proposals that the hydrothermal systems active during base-metal volcanogenic sulphide deposition in the Snow Lake area were associated with and driven by synchronous subvolcanic felsic plutonism.

Six additional holes were drilled through the Paleozoic carbonates south of Flin Flon to provide further control for the ongoing compilation of basement maps in NTS areas 63K, 63J, 63F and 63G.

Industrial mineral activities included mapping of a granodiorite near Flin Flon, detailed mapping and sampling of a talc occurrence at Iskwasum Lake, stripping and sampling a previously described marble occurrence at the Manasan Quarry, detailed mapping and sampling of an aplite-bearing pegmatite near the Manasan Quarry, and detailed mapping and sampling of a petalite-bearing leucogranite at Red Sucker Lake.

BISSETT

Recent fires in the Bissett district have added greatly to the amount of outcrop available for documentation. Detailed remapping of the metavolcanic and metasedimentary units appears warranted in the region between Wallace and Gem lakes.

The inventory of potential building stone in southeast Manitoba was extended to include granitic rocks close to Lake Winnipeg in the Berens and Pigeon rivers region. No new prospects were found, most of the outcrops being closely fractured and intruded by younger dykes.

The initial inventory of sphagnum bogs in the Interlake resulted in publication of a report by the Manitoba Remote Sensing Centre, based on the LANDSAT V Thematic Mapper. The technique has promising applications for more widespread use.

As an adjunct to the field program, industrial minerals staff also facilitated and acted as advisors to Sector C activities, a key component of which resulted in installation of granite curbing, cobblestones, and bollards in downtown Winnipeg.

Vegetation geochemical studies continued in the general vicinity of Bissett. Anomalously high levels of Pd and Au were detected in one of four samples obtained from the Mirage property.

THOMPSON

U-Pb studies in the Thompson belt and northwest Superior Province, conducted in co-operation with the Royal Ontario Museum, have defined two ages of Archean terrains in the Nickel belt, as well as clearly defining Hudsonian reworking at 1809 Ma and intrusion by younger granites at 1726 Ma.

Detailed mapping of the Pipe Pit generated a highly refined supracrustal stratigraphy for the Ospwagan Group, permitting correlation of this sequence with those at Ospwagan Lake, the Manasan Quarry, and Thompson Open Pit, as well as reinterpretation of the structures and structural sequence in this complexly deformed terrain.

As part of a co-operative program with the Department of Geological Sciences, University of Manitoba, new, major and trace element analyses of metavolcanic rocks from Moak and Assean lakes were compared with existing data from Ospwagan Lake and Fox River. The Moak and Assean lavas show some similarities, both being consistent with basin-margin settings, and with derivation from a relatively primitive mantle. Relatively high K and Rb values are explained as a result of sea-floor alteration. Assean and Ospwagan rocks tend to straddle the boundary between calc-alkali basalts and island-arc tholeiites, whereas those from the Fox River belt and Moak Lake appear to be restricted to the island-arc tholeiite field.

In the central Cross Lake area, a limited program of site checks and correlation studies completed the 1:20 000 scale mapping of supracrustals. A pilot study of the thermotectonic evolution of the Cross Lake area was initiated by the Free University of Amsterdam. Two granitoid units were sampled for geochronological studies at the Royal Ontario Museum.

NORTHWEST SUPERIOR PROVINCE

Detailed sampling of the late-Archean Magill Granite and associated pegmatites continued, and several new lepidolite-bearing pegmatites were identified east of McLaughlin Lake.

Petalite occurrences on Red Sucker Lake were remapped in detail and sampled to determine their suitability as a raw material for ceramics.

PHANEROZOIC

In the Phanerozic sector of the province, five separate projects entailed detailed drilling of the Winnipegosis reef at The Bluff on Dawson Bay, a regional Silurian correlation project, regional outcrop mapping in the Moose Lake area, drilling to basement near North Moose Lake, drilling and mapping north of Grand Rapids, and drilling for the Water Resources Branch in the City of Winnipeg to provide additional information on the Upper Red River aquifer. Fourteen core holes were drilled for a total of 1260 m.

The ongoing documentation of Karst features in the Grand Rapids Uplands resulted in the discovery of several new caves, bringing the total to 45. At least 20 others are known or reported from the southern Interlake.

Examination of Silurian outcrop and drill-core data in the Interlake confirmed the usefulness of sand and clay zones in correlating between the Hodgson and Grand Rapids areas. The new information

may resolve the «Inwood problem» in that more definite correlations now appear possible, equating the Lower Inwood of the southern area with part of the Fisher Branch, and the Upper Inwood to the upper part of the Moose Lake Formation of the northern area. Although numerous new fossil localities have been discovered and sampled, it is too early to comment on their potential as unique stratigraphic markers.

GENERAL

Work continues on several maps in the 1:250 000 scale bedrock compilation series. NTS sheets 63N (Kississing Lake), 64H (Northern Indian Lake), and 54E (Herchmer) are scheduled for release in November; 63 O (Nelson House) is to be displayed in draft form.

Throughout the summer, Branch staff led numerous field tours in the northern mining districts for the benefit of industry and other government geologists.

Displays and field tours of Manitoba Paleozoic Formations were provided in support of the American Association of Petroleum Geologists regional meeting in Bismark, North Dakota, and an outline of the Province's basal till programs was presented at the Minnesota Geological Survey Open House in Hibbing, Minnesota.

Following the format developed in 1987, this year's Report of Field Activities contains abstracts and summaries of the work undertaken in Manitoba by the Geological Survey of Canada as the federal contribution to the Canada — Manitoba Mineral Development Agreement.

Agencies across Canada appear well disposed to the Mineral Development Agreements as a mechanism for focussing the combined technical resources and expertise of the Federal and Provincial Surveys in support of the mineral exploration sector. Over the last 12 months a concerted effort has been mounted to develop a comprehensive program of exploration supportive surveys and mineral investigations that could be mounted over the next five-year period. Modelled in large part on the initiatives delivered during the 1984-89 period, this five year Workplan also incorporates numerous suggestions tabled by industry geologists.

Implementation of the initiatives would begin April 1, 1989, subject to receiving the appropriate approvals from the Federal and Provincial governments.

ONTARIO MINISTRY OF NORTHERN DEVELOPMENT AND MINES

MINES AND MINERALS BRANCH

ONTARIO GEOLOGICAL SURVEY

During 1988, the Ontario Geological Survey (OGS) carried out 54 detailed and regional scale geoscience studies throughout the province (figure 1). Additional projects were undertaken in co-operation with Mines and Minerals Division Resident Geologists, universities and consulting firms. The Ministry also supported 25 applied research programs at Ontario universities through the Geoscience Research Grant Program.

Short-term funding for a number of regional stimulation projects was provided through the Ministry's Northern Development Fund, and by the Canada — Ontario Mineral Development Agreement (COMDA).

PRECAMBRIAN GEOLOGY SECTION

The program of the Section reflected greater integration of economic geology studies with basic mapping and specialized research on Shield geology, through project teams with cross-disciplinary skills.

Figure 1. Distribution and types of programs in Ontario.

The major project of the Section, and the OGS, is the »Geology of Ontario» which consists of the production of 1) a 1:1 000 000 scale lithology map (partially completed), to be released in 1989; 2) a tectonic map which was started in 1988; 3) a comprehensive volume, for which a table of contents was conceived, and parts of the text written, in 1988. This publication is due to be released in the OGS centennial year of 1991. In addition, metallogenetic, geophysics and quaternary maps are planned as part of this project.

Compilation and synthesis of existing data on the geology of the Province has resulted in a fundamental reassessment of the Archean crustal evolution, leading to the conception of new tectonic models which are being addressed by the regional studies working group.

The first in the new series of 1:250 000 scale maps, initiated in 1987, covering NTS 52A, B, G, H, will soon be released. This map covers most of the area of the old Atikokan — Lakehead sheet (Map 2065). Compilation of data for the adjacent sheet, covering NTS 42 C, D, E, F, has begun.

Integrated, multi-disciplinary projects carried out over several years in the Wabigoon and Wawa areas are nearing completion. Synthesis of data from the Wabigoon studies is leading to production of 3 to 4 maps of the Rowan Lake — Kakagi Lake area and 2 to 3 maps of Lake of the Woods area, all at 1:50 000 scale.

Similar synopsis of commodity-oriented and detailed mapping projects in the Grenville Province will lead to production of revised, regional scale maps and reports.

A comprehensive investigation of the evolution of the Archean crust in the Abitibi belt was begun in 1988. The deep crustal seismic reflection transect of the belt initiated in 1987 was completed in this same year. The significance of the structural features deduced from these data are currently being field-checked.

Economic geology studies, concentrating on gold, were carried out primarily in the Abitibi — Wawa — Hemlo Subprovince. The results of the multi-year, multidisciplinary study of Archean lode gold deposits were compiled in a publication entitled «Archean Lode Gold Deposits in Ontario» and released in May, 1988. The Gold Research Group had a strong presence in the form of three oral presentations, 2 one-day workshops and six poster displays at the «Gold'88» international conference in Melbourne, Australia. The results of investigations into the potential for PGE deposits in Ontario was released as an Open File Report.

The Section is developing and applying a field-based, spatial computerization system, whereby data can be plotted on digitized maps, at various scales, directly in the field. This system will greatly facilitate the production of final coloured maps.

The research capability of the Section is enhanced through co-operative programs with outside institutions. Joint projects between the Section's geoscientists and geochronologists at both the Jack Satterly Laboratory, Royal Ontario Museum, and the Department of Physics, University of Toronto, are established to apply U/Pb and $^{40}Ar/^{39}Ar$ dating techniques to current geological problems. Similarly, the application of remote sensing to geological problems is being investigated in conjunction with the Ontario Centre for Remote Sensing.

ENGINEERING AND TERRAIN GEOLOGY SECTION

Quaternary Geology

The Quaternary Geology Subsection continued its program of the surficial mapping of the Province at a 1:50 000 scale. Multi-year projects in southern Ontario were undertaken in four areas: Barrie — Elmvale, Brampton, Chatham — Romney and Windsor — Essex. The mapping in these areas will determine the stratigraphy, the glacial history, and the distribution of surficial materials. The work around major population centres, such as Windsor and Metropolitan Toronto, will assist meaningful planning, and a balancing of urban-industrial growth and environmental concerns.

In northern Ontario, mapping and drift sampling projects continued in the Geraldton — Beardmore, Burke's Falls — Sundridge, and Shining Tree areas. Overburden drilling and sampling to complement previous mapping was completed in the Fort Frances — Rainy River and Matheson — Lake Abitibi areas.

All of these projects will provide a geological inventory and will aid in the development of an effective, drift exploration strategy for the respective parts of the province by the establishment of a glacial stratigraphy, and the generation of a geochemical data base.

An additional Quaternary project involved the sampling of overburden along the Trans Canada Pipeline right-of-way from Kirkland Lake to Thunder Bay. This sampling will yield information on regional glacial flow patterns and dispersion of bedrock during the last glaciation.

Quaternary staff were active in several professional organizations and scientific meetings throughout the year, and in developing the Quaternary geology contribution to the planned publication of the Geology of Ontario volume in 1991.

Paleozoic/Mesozoic Geology
The Paleozoic/Mesozoic Geology Subsection undertook an inventory of abandoned limestone and (or) dolostone quarries in the Province to complement a previous study made of active quarries, undertaken jointly by the Ministry of Natural Resources, various consultants and the Subsection. Staff members are producing new maps of the Paleozoic rocks of the Bruce Peninsula. This field investigation will provide a new geological interpretation, highlighting significant resource units. Also, a field investigation is being made of gypsum deposits in the Moose River Basin (James Bay Lowland). This project will not only study the deposits from a geological viewpoint, but will also look at resource development considerations. This work is being undertaken for the Industrial Minerals Section, Mineral Development and Lands Branch, MNDM.

Multi-Agency Group for Neo-tectonics in Eastern Canada
As the OGS contribution to the Multi-Agency Group for Neotectonics in Eastern Canada (MAGNEC), staff are making a structural geological study of the Paleozoic and quaternary deposits of Prince Edward County, in the Belleville area of Southern Ontario. The results from the study of possible neotectonic features in the county will provide updated information for a new building code in preparation.

Aggregate Assessment
The staff of the Aggregate Assessment Office continued with their assessment of aggregate resources of townships in southern Ontario, and initiated a detailed investigation of the buried aggregate potential of southwestern Ontario. Under COMDA, assessments of aggregate were undertaken in the towns of Bracebridge and Gravenhurst in the District Municipality of Muskoka, and in an area northwest of Fort Frances in northwestern Ontario.

GEOPHYSICS/GEOCHEMISTRY SECTION

Geophysical Program
During the 1988 field season, a project to research the potential for detecting and tracing conductive strata in Precambrian rocks under thick Huronian sediments continued. Gravity and transient electromagnetic data were completed at 50 m intervals near the town of Cobalt. Further transient electromagnetic surveying and electromagnetic sounding experiments are planned for the fall and winter months (1988-1989). Field surveying followed extensive computer modelling and field orientation so as to optimize surveying parameters and procedures. This project is funded under COMDA.

Gravity profiling was completed during the fall and winter of 1987-88, along planned seismic reflection transects within three areas, as part of two major Lithoprobe projects. Over 1850 gravity stations were established with a station spacing of 200 m Digital data collected from over 1850 stations with a spacing of 200 m, and the resulting profiles, will be released during the winter of 1989.

A compilation of reconnaissance-scale gravity and magnetic data of the Province, together with a summary of the major potential-field geophysical anomalies, was begun; it will be completed over the next few years. This work is being undertaken in co-operation with the Geological Survey of Canada. The generation of gridded information at a smaller interval will improve the high frequency content of the information, and provide a data base for the future production of colour maps for special studies.

An interpretation of gravity data, recently acquired over the Archean mafic to ultramafic intrusions in the Lac des Iles area, approximately 80 km northwest of Thunder Bay, has been completed. Gravity models of the main intrusion (mean density 3.13 g/cm^3) and the Tib Gabbro (mean density 2.97 g/cm^3) show these bodies to be shallow features with depth extents ranging from 3 to 5 km. The intrusions of the Lac des Iles area appear, from the results, to represent emplacements by discrete pulses of mantle-derived magma.

Two airborne electromagnetic-magnetic surveys, covering areas of high mineral potential, were completed in 1988. A survey of approximately 44 000 line km in the Tashota — Geraldton — Long Lac area, as well as a survey of approximately 36 000 line km in the Detour — Burntbush — Abitibi area will be released in the spring of 1989.

Geochemistry Program

The fifth and final year of a reconnaissance till sampling project, carried out in co-operation with the Engineering and Terrain Geology Section as part of the BRiM program, will continue until March 1989. Clastic sections of sonic-drill core are subjected to heavy mineral separation so that independent gold grains may be counted, and examined for their size and shape to help in determining their provenance. In the near future, Quaternary stratigraphy and till geochemistry data, collected in 1987 and 1988, will be released in standard formats; a summary report will follow.

During July and August 1988, the remaining lake sediment and water sampling (947 samples) required for a regional geochemical survey of the Batchawana Greenstone Belt was completed. This represents the second phase of a three-year project, carried out under COMDA, to provide geochemical information which is of direct application to exploration in the Belt.

A program to verify positive geochemical results obtained in 1987 during a regional lake sediment geochemical survey in the Goudreau Lake area was completed in March 1988. The verification procedure is based on the geochemistry of segments of long lake-sediment cores which extend from the water-sediment interface into the mineral matter below the organic layer.

During September, 1988, a small-scale regional geochemical survey, based on lake sediments and waters, was completed in a 400 km^2 area in the vicinity of the Magpie River. The Magpie River area is of particular interest because it lies to the west of the Goudreau Lake area, in which new gold deposits are currently being developed; and because parts of the area are covered by surficial deposits with only rare exposures of bedrock. The Magpie River survey will also act as part of an orientation survey for future regional geochemical coverage of the entire Wawa Greenstone Belt.

GEOSCIENCE LABORATORIES

1988 saw continued development of the technique of Inductively Coupled Plasma Mass Spectrometry (ICP-MS) for the routine determination of trace elements in geological materials. Elements now determined by ICP-MS at the OGS include yttrium (Y) and all the rare earth elements (REE), lead (Pb), thorium (Th), uranium (U), thalium (Tl), tin (Sn) and hafnium (Hf).

A major initiative within the Geoscience Laboratories continues to be «facilities planning» for the Sudbury Relocation Project. Following an extensive program of site visits throughout North America, the development of a «geoanalytical facility planning data base», and discussions involving the architect and a laboratory design consultant, a set of conceptual plans have been developed and approved. These plans call for a state-of-the-art geoanalytical facility incorporating the latest developments in design for safety, efficiency, contamination control, and environmental protection.

Using course materials developed at the OGS and field tested by the Department of Mineral Resources, Thailand, a two-part Geoscience Laboratories Manual is nearing completion. Part I is a comprehensive guide to laboratory practice; topics include: sampling, interpretation of analytical data, and each of the major analytical techniques. Part II is a «cookbook» of analytical methods, designed for use at the bench by technicians and scientists. Publication is planned for 1989.

GEOSERVICES SECTION

The Geoservices Section consists of the Geoscience Information Services Subsection, the Publication and Cartographic Services Unit, and the Geoscience Data Centre.

Geoscience Information Services was established in 1987 by the amalgamation of the Mines Library, Assessment Files Office and the Geoscience Information Office. The Mines Library maintains an information and reference service to Ministry personnel and the mining industry on the geology and mineral resources of Ontario. The Assessment Files Office (AFO) is the central depository for exploration reports submitted by the exploration industry. The Geoscience Information Office answers general geoscience inquiries from all sources and prepares general interest publications and displays on geoscience topics.

Publication and Cartographic Services (PCS), formerly the Scientific Review Office, continues to incrementally improve its electronic publishing system toward the goal of fully interactive editing capabilities for text, graphics, photographs, and maps.

The present areas of focus are: (1) improved productivity to provide more rapid release of geoscientific information about Ontario; (2) expanded capabilities for electronic cartography; (3) demand printing of mixed text and graphics materials.

From March 28 to June 27, 1988, PCS undertook a joint venture with the Geological Survey Division of the Thailand Department of Mineral Resources. The objective, to train Miss Supawadee Vimuktanandana, chief of the Cartographic Unit, in the methods of computer-assisted cartography used at PCS, was achieved by assisting Miss Vimuktanandana to produce a colour map, «Geology and Mineral Resources Map of Changwat Loei». With the help of PCS staff, she was also able to visit several other cartographic agencies, in both government and industry, to see as much of current cartographic technology as her schedule permitted.

The Geoscience Data Centre compiles data for contribution to a number of provincial and national geoscience data bases. For example, new OGS publications and exploration assessment work reports were indexed and added to both the in-house data base (ONTINDX) and the national GEOSCAN bibliographic file.

The Geoscience Data Centre also continues to research applications of a computerized Geoscience Information System (GEOSIS). Specific areas of research include multiple data set integration, data communications and graphics-text presentation.

GEOSCIENCE RESEARCH GRANTS

In 1988 the Ontario Geoscience Research Program (ORGP) awarded 25 grants totalling $500 000 to 10 Ontario universities. The grants finance mission-oriented research in Ontario, which is closely integrated with, but does not duplicate, the activities of the Ontario Geological Survey. Reports by ORGP recipients for the previous year were presented at the annual OGS Geoscience Research Seminar held on December 15 and 16, 1987.

MINISTÈRE DE L'ÉNERGIE ET DES RESSOURCES

GOUVERNEMENT DU QUÉBEC

SECTEUR «MINES»

Pour l'année financière 1987-88 l'objectif de base du ministre, en ce qui concerne le secteur Mines, est de promouvoir le développement de l'industrie minérale du Québec par un ensemble de mesures visant à appuyer l'initiative et le leadership du secteur privé, tout en s'assurant que l'exploitation des ressources minérales se fait selon les meilleurs intérêts des Québécois. Plus particulièrement, il s'agit de:

1. stimuler les investissements privés pour le développement de nouveaux gisements, l'expansion des capacités de production existantes et la modernisation des usines de première transformation;

2. localiser la recherche et le développement sur des projets spécifiques répondant aux besoins de l'industrie et pouvant aider à consolider notre position concurrentielle et susciter le développement industriel à court et moyen termes;

3. contribuer au renouvellement des réserves domestiques pour les minerais de cuivre et de zinc et favoriser la diversification de la production minérale dans les régions du Québec par la stimulation de l'exploration minière;

4. assurer la promotion et la défense de l'amiante et, au niveau mondial, promouvoir l'adoption de législations visant un usage sécuritaire de ce produit.

Chacune des trois directions générales du secteur «Mines» ainsi que la Direction de la politique et de l'évaluation répond plus spécifiquement à l'un ou l'autre des grands objectifs cités.

DIRECTION DE LA POLITIQUE ET DE L'ÉVALUATION

Financement et fiscalité

On estime à 130M$ les fonds souscrits en actions accréditives pour financer des projets situés au Québec et dont les dépenses sont valables pour l'année d'imposition 1988 (incluant donc des dépenses estimées pour janvier et février 1989). Les nouvelles offres réalisées au second semestre 1988 (toujours sur la base de l'année d'imposition) totalisent environ 40M$. C'est une baisse appréciable par rapport aux 532M$ observés en 1987.

Le budget du Québec présenté le 12 mai 1988 contient un certain nombre de mesures susceptibles d'affecter positivement l'industrie minière: baisse des taux d'imposition des particuliers, création de «comptes d'investissements stratégiques pour l'économie», mesures élargies concernant le régime d'épargne-actions, nouvelles mesures portant sur le financement de la R & D. Parmi les mesures spécifique à l'industrie minière, mentionnons:

- les exploitants de granite obtiennent le droit au remboursement de la taxe sur les carburants;
- le Centre Canadien d'Automatisation et de Robotique Minières (CCARM) a été reconnu comme entité admissible pour les fins du crédit d'impôt remboursable de 40% à la R & D.

Le 30 juin, le ministre des Finances du Québec annonce que les frais d'exploration admissibles au nouveau programme fédéral (PSEMC) seront aussi admissibles à l'allocation additionnelle du Québec de 33 1/3%, pour les frais d'exploration engagés au Québec par des particuliers.

Dans une déclaration ministérielle prononcée le 22 décembre, le ministre des Finances du Québec annonce une allocation additionnelle de 66 2/3% pour les frais d'exploration minière de surface engagés au Québec par des particuliers. Par ailleurs, l'Institut de recherche en exploration minérale (IREM) a aussi été reconnu comme entité universitaire admissible au crédit d'impôt remboursable de 40 % à la R & D.

Service de la statistique et Secrétariat des opérations
Le Service de la statistique a la responsabilité de fournir au secteur «MINES» toutes les données statistiques qui lui sont nécessaires afin de remplir son mandat. Ces données sont recueillies auprès des entreprises oeuvrant dans le secteur minier au Québec.

Plusieurs de ces données sont publiées chaque année au moyen de 10 publications différentes. Sept de ces publications sont de nature quantitative et trois de nature qualitative.

Liste des publications
- Statistiques sur l'investissement de l'industrie minérale du Québec
- Portrait statistique de l'industrie minière québécoise
- Statistiques sur l'industrie minérale
- Statistiques de la production minérale (mensuel)
- Statistiques de la production minérale — Pierre concassée (mensuel)
- Statistiques sur les mines d'or du Québec — 1986
- Statistiques sur les mines d'amiante du Québec — 1986
- Répertoire des établissements menant des opérations minières au Québec
- Annuaire des administrateurs des compagnies minières
- Renseignements sur les compagnies minières (trimestriel)

LA DIRECTION GÉNÉRALE DE L'INDUSTRIE MINÉRALE (DGIM)
La DGIM a pour mandat de favoriser le développement, l'exploitation et la transformation des ressources minérales du Québec par l'entreprise privée. Elle administre des programmes d'assistance financière et les législations minières. De plus, cette direction générale analyse les facteurs économiques et réglementaires qui ont une incidence sur l'industrie minérale en vue d'en dégager les orientations et les programmes gouvernementaux susceptibles de contribuer à l'essor des entreprises minières oeuvrant au Québec.

Programmes d'assistance financière

Infrastructures de développement minéral:
Ce programme est inscrit dans le cadre de l'Entente auxiliaire Canada-Québec sur le développement minéral. Son objectif est de favoriser l'implantation de nouvelles installations de production et de transformation de minéraux au Québec qui soient hautement productives et concurrentielles au plan mondial, grâce à une intervention gouvernementale qui assurera l'implantation des infrastructures nécessaires à leur avènement. En vertu de ce programme, la contribution des gouvernements au coût de construction des infrastructures (routes, lignes électriques, ponts, pipelines, sites résidentiels, aqueduc, égouts, etc.) pourra atteindre 20% du coût total du projet d'immobilisation.

Études technico-économiques:
L'objectif de ce programme est de favoriser l'élaboration de projets industriels miniers et d'inciter l'industrie minérale à analyser diverses avenues susceptibles d'améliorer sa productivité et sa compétitivité. En vertu de ce programme, une assistance financière de 50% du coût de réalisation d'études technico-économiques et de travaux d'expérimentation destinés à vérifier la praticabilité ou la viabilité économique d'un projet peut être accordée, avec un maximum de 250 000$ par projet. Cette assistance peut atteindre 75% des dépenses admissibles pour des études de marché et de commercialisation dans le secteur des minéraux industriels.

Droits payables par les exploitants:
Depuis le 23 avril 1985, les droits payables à même les profits annuels des entreprises sont fixés à 18%. De plus, l'exemption de base, qui était de 250 000$, a été remplacée par un crédit de droits de 90 000$. La partie de ce crédit qui n'est pas utilisée dans une année d'imposition peut être reportée sur les trois années ultérieures.

Par ailleurs, un régime de droits négatifs a été introduit dans la loi. Ainsi l'exploitant d'une mine au Québec et une société d'exploration minière peuvent se faire rembourser, à certaines condi-

tions, 18% de la perte d'une année, jusqu'à concurrence de 18% des dépenses d'exploration, de mise en valeur et de la dépréciation des investissements en immobilisations effectués depuis le 24 avril 1985 au Québec. La partie d'une perte qui ne fait pas l'objet du crédit remboursable est assujettie à la nouvelle règle de report des pertes.

Cette dernière permet maintenant à un exploitant de reporter les pertes d'un exercice financier sur les trois années précédentes et sur les sept années suivantes.

Impôt sur le revenu:
L'allocation de 66 2/3% pour frais d'exploration engagés au Québec par un particulier a été abrogée le 11 décembre 1986. Depuis cette date, les règles fiscales favorisant le financement de l'exploration sont sensiblement les mêmes au Québec et au fédéral: un contribuable peut déduire de ses revenus de toutes sources 100% de certains frais d'exploration, plus une allocation de 33 1/3% de ces frais, jusqu'à concurrence de 33 1/3% de son revenu (la limite est de 25% au fédéral).

Un particulier peut aussi déduire dans le calcul de son revenu imposable un montant variant de 50% à 100% du coût des actions admissibles au Régime d'épargne-actions du Québec. Le pourcentage varie selon la taille des actifs de la compagnie; il varie également suivant que les actions ont ou n'ont pas plein droit de vote.

Il convient aussi de signaler les nouvelles mesures fiscales concernant la recherche et le développement (R & D) qui ont été introduites dans le Discours du budget du 30 avril 1987. Pour les corporations, le crédit d'impôt sur les salaires versés à la R & D passe de 10% à 20%; le taux passe à 40% des dépenses courantes ou en capital si la R & D est faite dans une entité universitaire admissible. Les particuliers peuvent se prévaloir d'une déduction de 133 1/3% pour le financement de la R & D. La déduction est de 166 2/3% pour la recherche universitaire. Finalement, un chercheur étranger recruté par une entreprise peut bénéficier d'un congé fiscal de 24 mois.

Loi sur les mines
L'Assemblée nationale du Québec a adopté, le 23 juin 1987, la Loi sur les mines (projet 161, 1987, chapitre 64) dont la mise en vigueur a été proclamée le 24 octobre 1988. Le permis de prospection sera valide pour cinq ans; la période de validité du claim est portée à deux ans et il est renouvelable. La période de validité du bail minier est fixée à vingt ans et le délai pour commencer l'exploitation minière est de quatre ans.

Dans certains territoires du Sud du Québec, l'acquisition des claims se fera par désignation sur carte; au nord du 52° de latitude, le titulaire d'un permis d'exploration pourra enregistrer un claim sur tout le territoire (ou une partie du territoire) visé par son permis d'exploration.

Enfin, la loi assujettit certaines décisions du Ministre à la possibilité d'un appel à la Cour provinciale ainsi que d'un appel, sur permission, à la Cour d'appel.

Droits sur les mines
Sommairement, **la Loi concernant les droits sur les mines** comporte les modalités suivantes (certaines mesures sont en vigueur depuis le 24 avril 1985):

- la déduction à 100% des frais d'exploration et de mise en valeur;
- une allocation pour dépréciation de 30% du coût des actifs dépréciables;
- une allocation additionnelle de 33 1/3% de certaines dépenses prescrites;
- une allocation pour traitement égale à 8% ou à 15%, selon le stade de transformation, du coût des actifs dépréciables;
- le profit minier est assujetti à un taux fixe de taxation de 18%;
- les droits payables sont réduits d'un crédit annuel de 90 000$. La partie inutilisée de ce crédit est reportable sur les trois exercices financiers ultérieurs;
- un crédit remboursable de 18% est applicable s'il y a perte. Ce crédit est égal au moindre de 18% de la perte d'une année et de 18% des dépenses d'exploration, de mise en valeur et de la dépréciation déduites au cours de cette année;

- la partie d'une perte non admissible au crédit remboursable est reportable sur les trois exercices financiers antérieurs et les sept suivants.

LE CENTRE DE RECHERCHES MINÉRALES

Au cours de l'année 1987-88, le Centre de recherches minérales (CRM) a poursuivi avec vigueur ses activités. Le CRM est un atout précieux pour l'industrie minière québécoise en quête d'excellence. Il occupe une place de choix en recherche appliquée, tant dans le domaine de l'analyse minérale, la technologie minière, la minéralurgie et la métallurgie extractive.

Le CRM offre une gamme complète de services analytiques. En analyse minérale, il répond essentiellement aux besoins du ministère de l'Énergie et des Ressources dans le domaine de l'exploration géologique et de la recherche métallurgique. En 1987-88, pour la première fois dans l'histoire du Centre de recherches minérales, le nombre de déterminations a dépassé le million pour un coût supérieur à 1,7 million de dollars. À cette production, se sont ajoutés des contrats d'analyse confiés à des laboratoires commerciaux et universitaires. Ces travaux se sont chiffrés à près de 200 000 $. Le CRM développe également de nouvelles méthodes d'analyse et partage ses connaissances avec les employés des entreprises privées. La capacité d'analyse du CRM est l'une des pièces maîtresses d'une organisation consacrée au bon fonctionnement de l'industrie minérale québécoise.

Dans la même veine, le CRM dispose d'une équipe de minéralogistes compétents et d'instruments munis des derniers perfectionnements en matière de microscopie électronique à balayage, de microspie optique, de diffractométrie aux rayons-x et d'analyse thermique.

L'intérêt marqué du monde minier pour l'or s'est réflété au CRM par un accroissement des activités de technologie minière et de recherche métallurgique. En technologie minière, l'importance des projets commandités en 1987-88 (42 projets d'une valeur moyenne supérieure à 13 600 $) témoigne de l'intérêt de l'industrie minérale à l'égard des services offerts dans ce domaine. L'un des rôles du CRM est d'effectuer des transferts technologiques. A cet égard, le CRM publiait, en 1986, le premier d'une série de guides pratiques d'ingénierie minière, intitulé «Guide d'ingénierie pour les piliers de surface». Le second volume de la série, le «Guide d'utilisation du boulonnage», est paru en 1987-88. D'autres ouvrages de ce genre sont actuellement en préparation. Au cours de l'année écoulée, le CRM a consacré plus du tiers de son budget de technologie minière au maintien et à l'acquisition de connaissances nouvelles en environnement minier, en équipements mécaniques et en robotisation. Les universités québécoises ont été invitées à s'impliquer en technologie minière au moyen de contrats de recherche (se chiffrant à plus de 100 000 $) que leur a accordés le CRM.

En traitement des minerais, le CRM a poursuivi ses activités, au cours de l'année écoulée, de façon très active. Plus de 200 projets ont démarré dans le domaine de la minéralurgie. Les travaux réalisés se sont chiffrés à plus de 3,5 millions de dollars et près de 65% d'entre eux ont été réalisés avec la participation financière des entreprises. Ces projets ont surtout porté sur le traitement des minerais d'or (35%), des minéraux industriels (26%) et des minerais de fer (19%).

Des minerais provenant d'un dizaine de dépôts de l'Abitibi-Témiscamingue ont fait l'objet de travaux de caractérisation visant à déterminer leur teneur en métaux précieux et leur comportement pendant le procédé de cyanuration. Ces essais ont été réalisés en laboratoire, sur des échantillons de quelques kilogrammes et à l'usine-pilote sur des échantillons de plusieurs tonnes.

Dans le secteur des minéraux industriels, l'année 1987-88 a été marquée par de nombreux travaux associés à divers gisements de graphite, de magnésite, de silice, de dolomie, de talc, de kyanite et wollastonite.

L'activité a diminué dans le secteur des minerais de fer comparativement aux années précédentes. Les possibilités de collaboration avec les entreprises ont été réduites compte tenu du fait que le CRM s'est concentré sur le développement de nouveaux équipements pour ses laboratoires.

Dans un autre ordre d'idées, il convient de signaler les nombreux essais de démonstration de la colonne de flottation effectués sur divers minerais. Ces travaux ont été faits en collaboration avec le fabricant de cette invention québécoise.

En 1987-1988, le CRM a organisé deux colloques, l'un sur les minerais d'or et leur traitement, l'autre sur les équipements miniers. Ces colloques représentent une tribune privilégiée pour les transferts technologiques. Ils suscitent la concertation et encouragent les entreprises à investir dans la recherche et le développement.

LA DIRECTION GÉNÉRALE DE L'EXPLORATION GÉOLOGIQUE ET MINÉRALE

L'année financière 1988-89 fut comme l'année précédente marquée par un haut niveau d'activités en acquisition de connaissances géoscientifiques et par la consolidation du programme d'assistance financière à l'exploration minière.

L'année fut marquée par deux faits importants:

- l'implantation à Val-d'Or du Service géologique du Nord-Ouest;
- par la mise à l'essai du projet de géomatique dans la région de Rouyn-Noranda.

La DGEGM a consacré près de 12,4 millions de dollars sur le volet «acquisition de connaissances» et un montant de 7,9 millions de dollars a été consacré à des programmes d'assistance financière à l'exploration ainsi qu'à la préparation et à la diffusion de la géoinformation.

Direction de la recherche géologique

La Direction de la recherche géologique a pour mandat d'étendre et de raffiner la connaissance géologique de base du territoire afin d'en arriver à l'identification de zones à potentiel minéral élevé.

Pour la mise en oeuvre de ses programmes, la DRG a recours à un Service de géochimie/géophysique, à deux services géologiques (Nord-Ouest et Québec) et à une division des opérations de terrain. Les limites des divisions des deux services géologiques sont données à la figure 1.

Service géologique de Québec

Division Côte-Nord — Nouveau-Québec:
Cette division a disposé d'un budget de 2 415,7 k $, dont 1 165,6 k $ auront été consacrés à la Fosse de l'Ungava, 840, 6 k $ à la Fosse du Labrador, 221,0 k $ à la Côte-Nord et 188,5 k $ à la gestion interne. Les travaux de reconnaissance dans la Fosse de l'Ungava en étaient à leur sixième et dernière année. Touchant une superficie de 295 km X 100 km, ils auront compris une cartographie de base à 1:50 000 et l'étude des phénomènes structuraux volcaniques, sédimentaires, intrusifs et métallogéniques qui ont caractérisé l'histoire de ces terrains. Toute l'information obtenue sera synthétisée dans un mémoire qui sera préparé dans les prochaines années. Rappelons que les travaux entrepris dans cette région ont généré un regain d'intérêt pour la recherche des platinoïdes et de l'or.

Dans la Fosse du Labrador, les recherches métallogéniques entreprises au cours des années précédentes ont été continuées. La reconnaissance géologique et la métallogénie de l'or dans l'avant-pays de la Fosse se sont poursuivies et un nouveau projet de reconnaissance a été amorcé dans l'arrière-pays de la Fosse, dans le secteur favorable à la découverte d'indices de métaux précieux. Dans le segment oriental de la province de Grenville, les travaux ont été concentrés dans la région immédiatement au nord-est de la structure de Manicouagan afin d'en approfondir la connaissance géologique et de mieux définir le potentiel en cuivre, nickel et platinoïdes qui pourrait être associé aux complexes stratifiés qui affleurent dans ce secteur.

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Figure 1. Districts miniers du Québec

Division Montréal-Laurentides:
Avec un budget de 407,1 k $, les travaux de cartographie entrepris l'an dernier dans les régions de Thurso et de Maniwaki auront pu être poursuivis. La Division, conjointement avec la Division Estrie-Laurentides, s'intéresse aussi à un avant-projet portant sur l'évaluation du potentiel en platinoïdes dans sa partie de la province de Grenville.

Division Estrie-Laurentides:
Le budget de la Division est de 723,3 k $. Un programme de cartographie à 1:20 000, pour publication à 1:50 000, a été entrepris dans la région de Montmagny pour pallier l'absence de cette couverture dans le secteur. Ce programme, qui devrait faciliter la corrélation des unités géologiques pour l'ensemble des Appalaches du Québec, marque le début de travaux visant à fournir une nouvelle série de cartes géologiques à 1:50 000 pour la région des Appalaches. La couverture géologique à 1:20 000 en Estrie s'est poursuivie en quatre endroits et une étude sur l'évolution du volcanisme a été amorcée en Beauce.

Division Gaspésie — Les Îles:
La Division Gaspésie — Les Îles (i.e. Îles-de-la-Madeleine) dispose d'un budget de 804,2 k $ pour la continuation de synthèses stratigraphiques, structurales et métallogéniques, de même que pour le programme visant à produire une nouvelle couverture cartographique à 1:50 000. Rappelons que celle-ci tient compte des modifications stratigraphiques et structurales des vingt dernières années.

Division des minéraux industriels:
La Division des minéraux industriels dispose d'un budget de 478,9 k $ pour la poursuite des inventaires sur les minéraux industriels, tourbières et matériaux de construction. Ces inventaires ont porté tout particulièrement sur les granulats, la tourbe et le marbre dolomitique. La division travaille actuellement à constituer des banques de données sur les granulats et la tourbe et sur la production d'une série de rapports sur diverses substances minérales.

Service géologique du Nord-Ouest
Le Service géologique du Nord-Ouest est une nouvelle unité administrative régionale, localisée à Val-d'Or. Desservant tout le Nord-Ouest québécois, il regroupe les bureaux des géologues résidents de Rouyn-Noranda, de Val-d'Or et de Chibougamau.

Au cours de l'année 1988-89, le SGNO a consacré un budget de 2 254 k $ à la réalisation de 19 nouveaux projets et à la finalisation de 14 projets entrepris l'année précédente. Les nouveaux projets comprennent un levé régional, sept levés détaillés et onze études spécifiques.

Levé régional
La découverte récente de plusieurs indices aurifères a conduite à l'amorce d'un levé à 1:50 000 (32 G/4) de la bande Urban-Barry, au sud de Chibougamau.

Levés détaillés
Sept levés détaillés à 1:20 000 ont été réalisés au cours de l'été. Deux en sont à leur première phase. Il s'agit d'un levé et d'une compilation dans le secteur de Carpentier-Tavernier et d'un levé avec mise à jour de la compilation, dans le secteur de Chapais. Trois autres constituent des étapes dans des levés pluri-annuels, l'un dans la bande Caopatina-Desmaraisville et l'autre dans la bande Chibougamau-Matagami. Les deux derniers, qui touchent au complexe felsique de Joutel et au secteur de Harricana-Turgeon, ont atteint leur dernière phase: la rédaction des rapports finals (synthèse des données avec carte en couleurs) est amorcée.

Études spécifiques
Onze études spécifiques, dont six relèvent de la Division des gîtes minéraux, sont à mentionner.

Le projet Blake River, qui vise une meilleure connaissance de la stratigraphie des empilements volcaniques de la région de Rouyn-Noranda, s'est poursuivi. Des résultats très significatifs ont été obtenus.

Un inventaire des granitoïdes de la région de Val-d'Or a été amorcé. Plusieurs intrusions ont été échantillonnées: certaines ont été recartographiées.

L'étude du secteur de Cadillac, dans le cadre de la métallogénie de l'or dans le Nord-Ouest, en est à sa phase terminale. Neuf gîtes ont été étudiés par l'IREM. Six d'entre eux ont déjà fait l'objet d'un rapport. Restent à venir les rapports portant sur les gîtes Doyon, Bousquet et O'Brien, de même qu'un mémoire synthèse. L'étude du gisement Dumagami a été entreprise au cours de l'été; elle constitue une phase additionnelle des travaux sur le secteur de Cadillac.

L'étude des secteurs Joe Mann et Lac Shortt dans la bande Caopatina-Desmaraisville s'est poursuivie, avec l'UQAC comme maître d'oeuvre.

Dans le cadre d'un projet portant sur les métaux de base dans la région de Rouyn-Noranda, l'IREM et le MER ont procédé à l'étude des gîtes Ansil, Mobrun et Aldermac.

L'évaluation du potentiel en éléments du groupe du platine s'est poursuivie par la visite des indices du district de Rouyn-Noranda et l'examen préliminaire du Complexe de la Rivière Bell.

Finalement, une étude des couloirs de déformation dans la région de Chibougamau a été effectuée par R. Daigneault. Les résultats ont été communiqués aux géologues d'exploration à la faveur d'une excursion au cours du mois d'août.

Service de la géochimie et de la géophysique
Le budget du Service pour l'année financière 1988-89 a été de 2,222 K $ et il a permis la réalisation de 21 nouveaux projets dont les grandes lignes des principaux sont énoncées ci-après.

Division de la géochimie:

- Sédiments de lac: Natashquan

  Une campagne d'inventaire géochimique a été entreprise sur la Côte-Nord. Le travail de la présente année comprend les phases d'échantillonnage sur le terrain (par la firme SIAL Inc.) et d'analyses chimiques des échantillons (au CRM). Ultérieurement, la Division verra à traiter les données, à les présenter sous une forme adéquate et à étudier les résultats aux fins de définir le potentiel minéral.

  La région étudiée se situe entre Sept-Iles et Natashquan d'une part et le fleuve Saint-Laurent et le Labrador d'autre part. Plus de 5 500 échantillons y ont été prélevés, à raison d'un échantillon par 13 km^2.

- Sédiments de ruisseau: Papineau-Labelle

  Cet inventaire géochimique constitue la poursuite de la couverture entreprise l'an dernier. Un total de 1 813 échantillons ont été recueillis à raison d'un échantillon par 10 km^2. La région, échantillonnée par la firme CONSOR, s'étend entre les longitudes 73°45' et 75°30' et les latitudes 45°40° et 47°00'.

  Ce projet consiste d'abord en analyse de la fraction fine des sédiments de ruisseau. Elle consiste ensuite en l'étude de la fraction constituée par les minéraux lourds, afin d'ajouter à la résolution offerte par la fraction fine. Cette étude, particulièrement utile à l'exploration pour les métaux précieux, comprend la mesure du volume échantillonné, la concentration des minéraux par table à secousse de type Wilfley, la séparation de la magnétite et l'analyse géochimique de la phase résultante.

- Till: Surimau — Fournière

  Ce projet consiste en un échantillonnage systématique du till de base dans les cantons de Surimau et de Fournière, au S de la ville de Malartic. Il est présentement (sept. 1988) effectué sur 400 sites par la firme CORMIER en utilisant une foreuse de type Pionjar. Les échantillons, en plus d'être soumis à l'analyse géochimique, seront traités afin d'en concentrer les minéraux lourds, par la méthode des liquides lourds (bromoforme).

- Caractéristiques géochimiques des minéralisations du Québec

  Ce projet, commencé au cours de la présente année, est une tentative de caractériser la composition chimique des minéralisations et d'en définir les substances clés, pour en arriver à obtenir des catégories ou regroupements par similarités chimiques. Ceci permettra de reconnaître les meilleures substances indicatrices, d'orienter les travaux de prospection géologique et de mieux comprendre les dispersions d'anomalies géochimiques dans l'environnement secondaire. On peut aussi s'attendre à pouvoir corréler dispersions et types de minéralisations et, ainsi, déduire l'environnement géologique propre aux minéralisations.

Division de la géophysique:

- Gravimétrie: Chibougamau

  Ce projet concerne l'interprétation des données gravimétriques provenant d'une coupe à travers le camp minier de Chibougamau. Son but est de valoriser les données obtenues lors d'un levé gravimétrique réalisé en 1987.

- EM-mag: Lac Bourbeau, Chibougamau

  Ce projet consiste en un levé héliporté de données magnétiques et électromagnétiques le long de lignes espacées de 100 m. Ce levé a pour but de fournir des cibles d'exploration dans un district minier en difficulté.

- Interprétation de données géophysiques: Rouyn-Noranda

  Ce projet est réalisé par l'IREM. Il a conduit, pour une région à l'ouest de la ville de Rouyn-Noranda, à l'établissement d'une carte faisant état des données magnétiques, électromagnétiques et gravimétriques disponibles ainsi que de toutes les informations géologiques et géophysiques complémentaires.

- Interprétation intégrée: Joutel

  Confié à la société DIGIM, ce projet concerne l'extraction, à l'aide de techniques informatiques de pointe, de toutes les informations géologiques significatives et pertinentes à l'exploration minière dans la région de Joutel.

- Banque de données géophysiques

  Il s'agit d'un contrat en cours avec la société SIAL. L'objectif est la standardisation et le codage des données géophysiques numériques ainsi que le développement d'un logiciel interactif. Suite à l'achèvement de ce contrat, en mars 1989, une banque de géophysique aura été constituée, laquelle a reçu le nom de MAGGY (magnitudes, géophysiques) en mai dernier.

Direction de l'assistance à l'exploration minière

Service d'assistance technique et financière

La division des programmes d'aide à l'exploration a géré trois programmes d'assistance financière en 1988-1989. Ces programmes qui font partie d'ententes fédérales-provinciales sont:

1. Le programme d'assistance financière à la prospection dans la région du Bas-Saint-Laurent et de la Gaspésie.

2. Le programme d'assistance financière à la prospection minière en Estrie-Beauce.

3. L'assistance financière pour le soutien de l'exploration minière dans les communautés minières en difficulté.

Dans le cadre du programme de la Gaspésie, 96 prospecteurs ont bénéficié d'assistance financière et neuf propriétés ont été amenées à des stades où elles sont maintenant prêtes pour des campagnes d'exploration avancées.

Dans la région de l'Estrie-Beauce, cinq subventions ont été accordées pour appuyer des projets d'autant de compagnies. Une étude est présentement en cours pour arriver à une politique qui permettrait de sensibiliser le milieu à l'exploration et de favoriser son implication.

Dans le cadre du soutien aux communautés en difficulté, des subventions furent accordées à Minnova à Chapais et à Explorations Noranda à Murdochville, ainsi qu'en Gaspésie. Ces subventions visent à encourager la diversification et la découverte de nouvelles réserves qui assureront la survie à court et moyen termes de ces deux localités.

Un total de 3 M $ fut accordé en subventions à l'exploration en 1988-89.

La division de la mise en valeur de la géoinformation a continué à oeuvrer à l'informatisation de son fichier sur les gîtes du Québec. Environ 3 500 fiches ont été transposées du format manuel au format informatique et intégrées au nouveau système. Les listes mensuelles des nouveaux indices minéralisés ont été préparées et mises à la disposition du public pour consultation. Des cartes minérales ont été préparées pour les régions de l'Estrie-Beauce, de la Fosse du Labrador et de la Gaspésie. Les deux premières seront publiées en 1989.

La mise à jour des cartes de localisation des travaux géoscientifiques s'est poursuivie. Une nouvelle équipe de travail a été mise sur pied pour terminer en 1989 l'ensemble de cette mise à jour en date de décembre 1989. Ainsi, à la fin de 1989, deux des trois principaux produits de compilation du Ministère seront en état d'être incorporés au futur système d'information géoscientifique à références spatiales.

Service de la géoinformation

Dans le cadre d'une étude de faisabilité d'implantation de systèmes informatisés de production, de traitement et de diffusion de l'information géoscientifique, le Ministère a réalisé une mise à l'essai de techniques géomatiques. Cette mise à l'essai a conduit à la création d'un système expérimental d'informations géoscientifiques à références spaciales pour un territoire localisé au nord de Rouyn, couvrant le feuillet SNRC 32D/06. Des travaux de numérisation des données analogiques et de transfert de données numériques existantes concernant ce feuillet ont permis l'intégration de ces données dans un système informatique pouvant gérer, à la fois, des données graphiques et alphanumériques.

Les résultats préliminaires de ce projet ont confirmé le grand potentiel qu'offre la géomatique dans l'amélioration des modes de gestion de l'information géoscientifique. Une analyse exhaustive des résultats de cette expérimentation permettra de dégager des conclusions précises quant à la faisabilité et à l'opportunité d'utiliser les technologies de géomatique dans la gestion des données géoscientifiques du Ministère. Ces analyses serviront à la conception administrative du système éventuel à implanter.

Le Ministère entend, dans les quatre prochaines années, consacrer prioritairement ses efforts à implanter un système intégré d'informations à références spatiales afin de le conduire à des modes de gestion mieux adaptés aux exigences de la clientèle des années 90.

Par ailleurs, en 1987-88, le Service a édité et mis à la disposition du public 147 nouveaux documents géoscientifiques produits par le Ministère; ces documents comprenaient 538 cartes géologiques, géochimiques ou géophysiques. Au cours de la période, la clientèle a commandé quelque 36 000 copies de rapports publiés par le Ministère.

De plus, le Service a reçu et mis à la disposition de la clientèle quelque 1 600 nouveaux dossiers d'exploration minière soumis en vertu de la Loi sur les mines. La clientèle est maintenant avisée de la disponibilité de ces dossiers ainsi que de celle des rapports géoscientifiques du Ministère par l'entremise d'un nouveau bulletin mensuel «Repères» à présentation améliorée. Ce bulletin est produit et mis à la poste dans les dix jours ouvrables suivant la fin du mois concerné.

NEW BRUNSWICK DEPARTMENT OF MINERAL RESOURCES AND ENERGY

MINERALS AND ENERGY DIVISION

The New Brunswick Minerals and Energy Division responsible for all mineral and energy resources owned and controlled by the province. The Division administers, through a number of Acts, all matters related to exploration, development, production, smelting, refining, transportation and taxation of metallic, nonmetallic and structural mineral resources. The division consists of the Geological Surveys Branch, the Mineral Development Branch and the Energy Branch.

In past years, most of the geoscience activities were carried out by the Geological Surveys Branch with funds derived from the Canada — New Brunswick Mineral Development Agreement that expires March 31, 1989. The Provincial «A» budget, however was given a substantial boost by the new Minister, Morris Green, who was appointed in 1987, following the election of a new Liberal government. The increased funding will add three geoscientists to the Geological Surveys Branch staff and provide mineral exploration incentive programs in 1988-89.

GEOLOGICAL SURVEYS BRANCH (Director, J.L. Davies)
The Geological Surveys Branch is responsible for the collection and dissemination of information pertaining to the geology and mineral resources of New Brunswick. Closely associated activities include the encouragement of mineral exploration, promotion of the mineral industry, and provision of assistance to government agencies which formulate resource and land use policies. For the structure of the Branch see page 10).

MINERAL DEVELOPMENT BRANCH (Director, G.J. Greer)
The Mineral Development Branch consists of four sections: Mineral Development, Mineral Processing, Mine Engineering, and Mineral Lands.

The overall goals of the Branch are (1) to ensure that mineral deposits are developed at an optimum rate consistent with long-term income and employment objectives, (2) to enhance the economic viability of marginal mineral deposits, (3) to ensure that inactive or exhausted mines are rehabilitated to a state that avoids on-going costs to the public, (4) to ensure optimum recovery of minerals both in the mining and milling of the ores, and (5) to ensure the highest degree of in-province processing of mineral concentrates.

ENERGY BRANCH (Director, D.E. Barnett)
The Energy Branch has responsibility for all energy matters and, in this regard, is involved in a number of geoscience projects. These include assessment of coal, oil, gas, and oil shale resources by means of geological compilation of the Late Paleozoic Maritimes Basin and the Early Mesozoic Fundy Basin. The oil shales of Albert County are being drilled and analyzed to determine the beneficiation potential of the kerogen and/or carbonate minerals. A Mineral Development Agreement project is underway to study the sedimentology and diagenesis of the Stoney Creek oil and gas field near Moncton.

MINERAL DEVELOPMENT AGREEMENT (MDA) PROGRAMS

Northern New Brunswick

D.M. Burton embarked on a geological-geochemical study of the new gold discoveries in the Upsalquitch Forks (NTS 21 O/10) area (Figure 1, A). Three styles of gold mineralization were recognized: (1) auriferous mafic intrusions that intrude Silurian and Devonian siltstones and mudstones, (2) auriferous intermediate intrusions, and (3) polymetallic gold-quartz-calcite veins in mafic intrusions.

G.R. Philpott mapped some 450 km^2 of the Silurian — Devonian volcanic belt south of Campbellton (Figure 1, B) to investigate the gold potential of the region, and to classify the plutonic-volcanic relationships. The results of this work are presently being assembled for publication.

A.G. Pronk mapped the Quaternary geology of Campbellton (NTS 21 O/15), Oak Bay (NTS 21 B/1) and Escuminac (NTS 21 B/2) areas (Figure 1, C). Ice movement was dominantly west to east with a secondary movement northeast. A south-southeast flow pattern along the Baie de Chaleur precedes the northeasterly movement. A wave-cut platform about 5 m above sea level is considered to be an older feature, possibly Sangamonian.

The geocompilation project, involving plotting and correlation of all exploration data, was completed in the California Lake area (NTS 21 O/8) (Figure 1, D) in the middle of the Bathurst-Newcastle area. This information is now being prepared for publication.

D.G. Rose and S.C. Johnson have completed work on a computerized mineral deposits file for the Province. The file will be available following the completion of an operating manual.

The University of New Brunswick (P.F. Williams and A.L. McAllister) completed the second year of study of the Heath Steele massive sulphide deposits (Figure 1, E). The 1987 work comprised detailed stratigraphic and structural synthesis, and magnetic and VLF-electromagnetic surveys near the sulphide deposits. Approximately 3000 m of trenching was completed. The aim of the project is to identify additional ore reserves.

R.A. Wilson continued his geological mapping in northwestern New Brunswick covering the Riley Brook (NTS 21 O/3), and Grand Falls (NTS 21 O/4) map areas (Figure 1, F). The area is underlain by folded Silurian and Devonian volcanic and sedimentary rocks, unconformably overlain by red Mississippian sediments and minor gypsum.

Trace-element abundances indicate that Silurian — Devonian mafic volcanism was related to an extensional, within-plate tectonic environment.

Southern New Brunswick

Field work by S.E. Watters in gold-bearing rocks of the Bay of Fundy coastal zone focused on the large amount of diamond-drill core obtained from the Cape Spencer area (Figure 1, G). A three-dimensional model of the zone indicates an easterly plunge to the Gordex gold horizon. The mineralized zones are characterized by alteration haloes consisting of illite, carbonate, silica and chlorite. Argon39/Argon40 dating indicates the alteration is Permian in age. A close correlation exists between pyrite abundance and gold content. It appears that pyrite, the main gold-bearing mineral, precipitated readily where specularite was available as a source of iron.

M.J. McLeod completed his study of the eastern Saint George Batholith (Figure 1, H). There is a strong structural control in the emplacement of late granitic phases and tin-tungsten mineralization. The latter occurs in intensely fractured equigranular biotite microgranite. W.W. Gardiner began geological mapping of the western part of the batholith (Figure 1, I), and his initial conclusions regarding the distribution of late granite phases and tin-tungsten mineralization are similar to McLeod's.

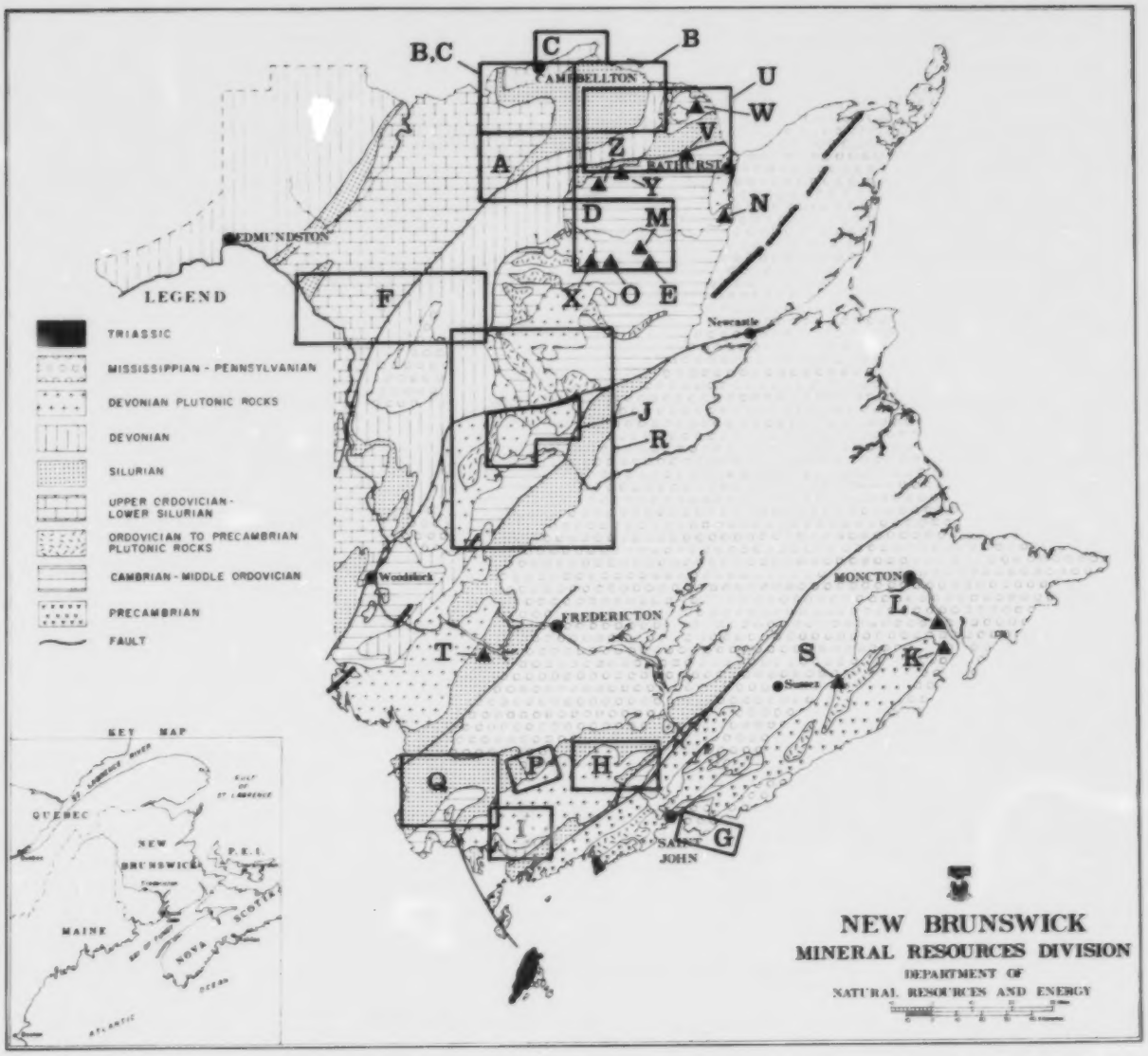


Figure 1. MDA-funded geoscience projects: (A) Upsalquitch Forks area gold study (NTS 21 O/10); (B) gold potential of Silurian-Devonian volcanics (NTS 21 O/15, 16); (C) Quaternary geology (NTS 21 O/15, 22 B/1, 2); (D) geocompilation project (NTS 21 O/8); (E) Heath Steele mine structural study; (F) geological mapping (NTS 21 O/3, 4); (G) mapping of gold-bearing rocks, Cape Spencer area; (H) mapping, eastern Saint George Batholith; (I) mapping, western Saint George Batholith; (J) mapping, Burnthill Pluton; (K) Albert Formation study; (L) Stoney Creek oil and gas field study.

Provincially funded geoscience projects: (M) Stratmat deposit study; (N) Key Anacon deposit study; (O) Half Mile Lake deposit study; (P) Mount Pleasant caldera study; (Q) surficial geology (NTS 21 G/6); (R) amphibolite study in Miramichi Zone.

Properties being explored or developed: (S) Mechanic Settlement platinum; (T) Lake George antimony mine; (U) Alcida-Upsalquitch River belt; (V) Quebec Sturgeon River deposit; (W) Nigadoo base-metal mine; (X) Maliseet (Goodwin Lake) deposit; (Y) Caribou massive sulphide deposit; (Z) Murray Brook deposit.

H.E. MacLellan and L.R. Fyffe completed their study of the epizonal tin-tungsten-bearing granite plutons of Middle Devonian age in the central Miramichi highlands (Figure 1, J). The significant concentrations of cassiterite and wolframite are generally associated with equigranular granite, either within the granite or in metasedimentary rocks in contact aureoles.

ECONOMIC DEVELOPMENT

In 1987, geoscience projects under the above programs comprised an investigation of the diagenesis of the Albert Formation sandstones by A.H. Chowdhury (Figure 1, K), and a study of the Stoney Creek oil and gas field south of Moncton (Figure 1, L).

PUBLIC INFORMATION, EVALUATION AND ADMINISTRATION

This program, directed by D.J.J. Carroll, is aimed at promoting the MDA and the mineral industry in general, and publicizing the benefits of the program to the Province. The program also includes editorial services related to publication of project results. The latter is looked after by B.M.W. Carroll and S.A. Abbott.

PROVINCIAL PROGRAMS

R.R. Irrinki is compiling an inventory of base metal and gold deposits in New Brunswick. Confidential reports were prepared on the Stratmat (Figure 1, M), Key Anacon (Figure 1, N), and Half Mile Lake (Figure 1, O) massive sulphide deposits of the Bathurst-Newcastle area. The tonnage and grade calculations are based on four computer files created for each deposit. The files detail the location and attitude of drill holes as well as assay and geological data.

S.R. McCutcheon completed the Mount Pleasant caldera study (Figure 1, P). He recognizes five rock sequences: (1) precaldera, (2) exocaldera, (3) intracaldera, (4) late caldera-fill, and (5) postcaldera. The Mount Pleasant deposit lies on the southwest edge of the caldera over a «ring fracture zone».

P.G. Chiswell carried out surficial geology mapping in the Rollingdam area (NTS 21 G/6) (Figure 1, Q) and collected 140 samples of till for base- and precious-metal analysis.

L.R. Fyffe studied the distribution of high-grade metamorphic rocks in the Miramichi Zone of central New Brunswick (Figure 1, R). The petrochemistry of amphibolites (derived from mafic volcanic rocks) from three areas is consistent with the model indicating that Tetagouche Group (Ordovician) volcanic rocks formed in a back-arc environment, southeast of the Paleozoic Iapetus Ocean.

G.W. Crouse collected 20 000 m of drill core for the Provincial libraries, and new facilities are being built for core storage in Fredericton and Bathurst. G.W. Crouse is also coordinator of a mineral exploration incentive program that was launched in May, 1988.

EXPLORATION

In 1987, gold was the main stimulant to mineral exploration in New Brunswick, as it has been for the past several years.

Gold was discovered in New Brunswick more than 100 years ago, but the spectacular success of base-metal exploration and mining had drawn much of the attention away from gold exploration until recently. It is important to note that one of the largest potential gold reserves in the Atlantic Provinces is contained within massive sulphide deposits in the BathurstNewcastle area.

Because of gold exploration in the Province in the 1980s, at least two regions with high potential for gold deposits have been outlined along the Bay of Fundy coast near Saint John, and in the Alcida — Upsalquitch region north and west of Bathurst.

The important gold-bearing terranes outlined to date are associated with large regional thrust-wrench fault systems near the boundaries of major tectonostratigraphic zones.

Southern New Brunswick
Intense exploration has revealed several significant gold deposits along the Bay of Fundy coast. An extensive drilling program east of the Gordex Minerals Limited gold mine has outlined large gold-bearing quartz-carbonate zones that will increase the potential ore reserves.

Mispec Resources Inc., Glenvet Resources Ltd., Brunex Gold Resources Ltd., Cuvier Mines Inc., Lacana Mining Corporation, Mactaquac Mining Ltd., Brunswick Mining and Smelting Corporation Limited, and several prospectors explored gold occurrences in the Caledonia Zone. One prospector, Robert Baxter, staked an interesting platinum occurrence in an ultramafic pluton near Mechanic Settlement (Figure 1, S).

Although most of the interest was in the coastal zone, several interesting gold discoveries were made in other areas. These include the Annidale silver-gold prospect (LAC Minerals Limited), the Evandale copper-gold prospect (Costigan Gold Corporation), and the Shear Mine gold prospect (Stratabound Minerals Corp.). Brunswick Mining and Smelting Corporation Limited and Goldfluor Explorations Ltd. explored interesting prospects northeast of South Oromocto Lake. Gold discoveries made by Goldfluor Explorations Ltd. stemmed from the results of a till survey by the Department of Natural Resources and Energy.

The most important mineral deposit found in this region so far, the Mount Pleasant tungsten-tin deposit (Figure 1,P), is currently being investigated by LAC Minerals Limited. The company completed its exploration program at the Mount Pleasant site late in 1987. By the end of the year, the feasibility study on developing a tin zone about 1 km north of the tungsten deposit was completed and the report was under review by company officials. A decision concerning development of this zone is expected early in 1988. The reserves are estimated to be 5 900 000 tons (5 352 000 t) of ore grading 0.79% tin. Further exploration is planned for the Mount Pleasant area in 1988.

The discovery of gold in the lower levels of the Lake George antimony mine (Figure 1, T) has also increased interest this region. Drilling by Dominion Explorers Inc. late in 1987 was partly funded by the Mineral Investment Stimulation Program (MISP) of the Canada — New Brunswick Mineral Development Agreement (1984-1989).

Northern New Brunswick
Gold exploration was most intense in the Silurian — Devonian volcanic and sedimentary terranes (Tobique-Chaleur Zone), but activity has recently expanded into adjacent regions. The realization that Devonian and Silurian epithermal systems are present in fractured Ordovician (Tetagouche Group) rocks has led to increased activity in the Miramichi Zone, long known for its large base-metal deposits. Lacana Mining Corporation has discovered an interesting silver-bearing fracture system northwest of California Lake, and Acadia Mineral Ventures Limited has found an interesting antimony-gold occurrence in the Sevogle River area.

Interest is also spreading to the northwestern part of the Province. This region is underlain by a thick sequence of turbidites of the Matapedia and Grog Brook groups.

In 1987, exploration continued at a high level in the 80 km Alcida-Upsalquitch River belt (Figure 1, U). Several gold occurrences have been found in this terrane, which straddles regional thrust-wrench fault systems. In the western part of the belt, Lacana Mining Corporation and Noranda Exploration Company, Limited have discovered several new occurrences associated with carbonate-quartz alteration in mafic plutons.

Lacana Mining Corporation has discovered a new gold occurrence near Rocky Brook in the central part of the belt. The results of a drilling program in late 1987 have not been reported. The most significant discovery to date is the Lacana Alcida deposit (30% owned by Acadia Mineral Ventures Ltd.) at the northeastern end of the belt, 21 km northwest of Bathurst (Figure 1, U). Several drill holes put down since 1986 have outlined approximately 300 000 tons (272 000 t) of ore grading 0.15 ounce/ton (5.14 g/t) gold. The most recent drilling program was partly supported by a MISP grant.

Lacana Mining Corporation also investigated the gold potential of several other promising areas, including the old Quebec Sturgeon River base metal-silver vein deposit (Figure 1, V) that was discovered in the 1880s and developed in the 1950s. This deposit is one of several discovered along the Rocky Brook — Millstream Fault within the last 100 years. Drilling related to this project was also supported by a MISP grant.

Acadia Mineral Ventures Limited spent more than $1 million in northern New Brunswick in 1987. In association with Seabright Exploration Inc., Seabright Resources Inc., Lacana Mining Corporation, and Cuvier Mines Inc., the company explored several properties in the Alcida-Upsalquitch belt and Miramichi Zone to the south (Northern Miner, Sept. 14, 1987). Several targets were located, including some along the Rocky Brook — Millstream Fault. These targets were all drilled in late 1987, but no results have been reported so far.

Noranda Exploration Company, Limited and Brunswick Mining and Smelting Corporation Limited continued to assess many prospects in several areas, but report nc new discoveries. Noranda Exploration negotiated a joint venture with Lucero Resource Corp. to investigate several gold occurrences in the Upsalquitch area, but to date no results have been announced.

In other developments, Shamrock Resources Inc. obtained the Nigadoo base-metal mine (Figure 1, W). The northerly extension of the veins was investigated for gold potential. Granges Exploration carried out a drilling program on the Maliseet (Goodwin Lake) nickel-copper deposit (Figure 1, X), mainly to determine its platinum potential. Inco Gold Company outlined an interesting gold prospect in granitic and metamorphic terrane of the Serpentine Lake area by analyzing tills and heavy-mineral samples from streams.

Several other companies and individuals explored parts of New Brunswick in 1987: J.D. Irving Limited, Heron Mines Ltd., Sharpe Energy and Resources, Lone Pine Exploration Ltd., Falconbridge Limited, Tintina Mines Limited, Shediac Bay Resources Inc., Mascarene Mines Ltd., Sullivan Resources Inc., Kinbauri Gold Corp., Rex Silver Mines Ltd., Highbourne Explorations Ltd., Appalachian Resources Inc., U.S. Borax Inc., and Stratabound Minerals Corporation.

DEPOSITS BEING DEVELOPED

In December 1986, East West Minerals Inc., a wholly owned subsidiary of East West Minerals N.L. of Sydney, Australia, purchased Anaconda Canada Exploration Ltd. from Atlantic Richfield Co. The purchase included the rights to the Caribou massive zinc-lead-silver sulphide deposit located 40 km west of Bathurst (Figure 1, Y).

The newly established company, Caribou New Brunswick Mining Ltd., has taken a «fast track» approach to mine development and intends to be in production by mid-1988.

Caribou New Brunswick Mining Ltd. is expected to spend $40 million on capital investment during the development and could employ approximately 185 people when operating. Ore from the underground cut-and-fill operation will be supplied to the on-site concentrator at a rate of 2000 t/d (Northern Miner, Sept. 14, 1987). The bulk leadzinc concentrate produced in the mill will be marketed in Europe.

Northumberland Mines Ltd. has received approval of its reclamation plan and is in the process of acquiring the necessary approvals to proceed with development of the Murray Brook gold and silver gossan, 50 km west of Bathurst (Figure 1, Z).

The operation will be an open-pit mine supplying ore at a rate of 1000 t/d. The ore will be treated using the cyanide vat leach process. A workforce of 25 to 30 employees is anticipated at the mine, which will have a life of about six years.

NOVA SCOTIA DEPARTMENT OF MINES AND ENERGY

MINERAL RESOURCES DIVISION

INTRODUCTION TO THE DEPARTMENT

Encouraging research and development leading to increased mineral and energy resources, and promoting their orderly regulation and use are the dual mandates of the Department. In fulfilling these mandates, the Department is divided into the Mines and Minerals Branch and the Energy Branch. Three divisions in the Department, Mineral Resources, Mineral Development and Energy Resources, administer geoscience projects.

MINES AND MINERALS BRANCH

The Mines and Minerals Branch promotes an understanding of the geology and mineral resources of the province, the exploration, development and efficient production of mineral deposits and the maintenance of safe and environmentally acceptable mining practices. The Branch has three divisions: Mineral Resources, Mineral Development and Mining Engineering.

The Mineral Resources Division undertakes long-term, applied research to provide an understanding of the province's mineral resources and geology through the Regional Surveys, Mineral Deposits, and Geochemistry and Quaternary Geology sections. The Division provides staff and support for the Education and Public Awareness Program of the Mines and Minerals Branch.

The non-metallic mineral resources of the province are mapped, described and promoted by the Resource Geology Section of the Mineral Development Division. The section provides additional services to the mineral industry and the public with the operation of two libraries, a core library, GEOSCAN and other data bases, and a regional office. The Division also houses the office of the Registrar of Mineral and Petroleum Rights.

ENERGY BRANCH

The Energy Branch initiates and implements policies and programs to decrease the province's dependency on imported fuels, through the promotion of energy conservation and the development of indigenous energy resources. The Branch is comprised of two divisions: Energy Resources and Energy Management.

The Energy Resources Division is divided into the Petroleum Resources Section and the Coal Section. The sections are responsible for evaluating all deposits of coal, peat, oil shale, natural gas and petroleum, and regulating their development.

ENCOURAGING THE MINERAL INDUSTRY

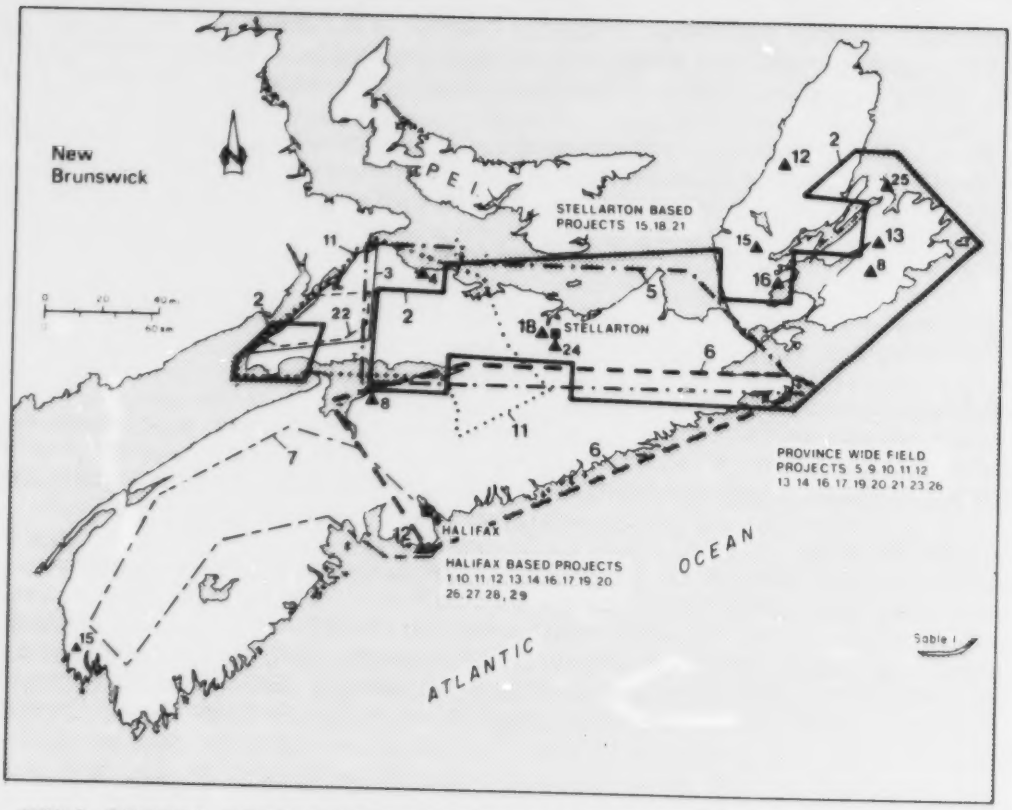
The work of the two branches encourages exploration for, and development of, the energy and mineral resources of Nova Scotia. Since June 1984, the Department has been aided in this objective by the signing of the five-year Canada — Nova Scotia Mineral Development Agreement (CNSMDA). The Agreement is valued at $26.9 million — $16.1 million from Canada and $10.8 million from Nova Scotia — and supports five major programs to strengthen and develop the province's mineral industry. Most of the geoscience projects described here are supported by the CNSMDA (see the accompanying map); but these are only a small part of the total work on the Agreement.

GEOSCIENCE ACTIVITIES

A wide variety of geoscience activities are being undertaken by the staff of the Department. These projects can be categorized as follows: 1) energy resources studies; 2) metallic and non-metallic mineral resources and deposit studies; 3) regional mapping; 4) geochemistry and quaternary research; and 5) services to industry and the public. A total of 53 geologists are working for the Department on these projects.

Energy Resources Studies

Evaluation of the province's energy resources includes geologically mapping coal, peat and oil shale deposits, and monitoring private sector geological exploration for petroleum and natural gas.



NOVA SCOTIA DEPARTMENT OF MINES AND ENERGY, 1987 PROJECTS

MINERAL RESOURCES DIVISION

1. Catchment Basin Geochemical Study of the Cobequid Highlands *
2. Regional Reconnaissance Geochemical Project *
3. Cumberland Basin Project *
4. Pugwash Mine Salt Project *
5. Quaternary Mapping and Till Geochemistry Project *
6. Meguma Gold Project *
7. South Mountain Batholith Project *
8. Base Metals Deposits Project *
9. Metallogenic and Tectonic Studies *
10. Public Awareness and Education *

MINERAL DEVELOPMENT DIVISION

11. Aggregates Projects *
12. Building Stone Project *
13. Gypsum and Anhydrite Project *
14. Diatomaceous Earth Project *
15. Various Commodities Project *
16. Fillers and Extenders Field Investigations Project *
17. Gold Resources Project *
18. Core Library and Core Repository Project *
19. Bibliographic Database Activity *; Mineral Occurrences Database Activity *; Drillhole Database Activity *; Gold Bibliography *
20. Mineral Land Use Policy Development *
21. Regional Office; Exploration Monitoring

ENERGY RESOURCES DIVISION

22. Cumberland Basin Seismic Project; Coal Deposition and Sedimentology Study *
23. Oil Shale Project *
24. Coal and Oil Shale Exploration
25. Sedimentology of the Hub Seam, Prince Colliery
26. Petroleum Exploration Monitoring
27. Offshore Petroleum/Natural Gas Evaluation
28. Onshore Petroleum/Natural Gas Evaluation *
29. Coal Geology Computer Database *

*** Indicates projects completely or partially funded by the Canada-Nova Scotia Mineral Development Agreement**

Figure 1. Locations and types of Geoscience projects undertaken by the Nova Scotia Department of Mines and Energy.

The Department, through the Energy Resources Division, is responsible for all petroleum and natural gas exploration monitoring and development activities onshore. It works in conjunction with the Canada Oil and Gas Lands Administration in administering the offshore portion of Nova Scotia.

The study of oil shale resources continued in 1987 with field investigations in Cape Breton, and detailed stratigraphic mapping in the Stellarton graben where oil shales and coal seams are closely associated. Results were released in Open Files Reports and formal publications. The potential for oil and natural gas resources in onshore areas of the province was addressed through thermal maturation and reservoir studies in northern Nova Scotia and Cape Breton Island.

Coal resources in the western Cumberland Basin, Stellarton graben and Cape Breton were part of a continuing program of regional mapping and coal seam investigations.

Mineral Resources and Deposits Studies
Both metallic and non-metallic mineral deposits are being investigated to increase the knowledge and understanding of minerals resources in Nova Scotia. The CNSMDA supports marketing research and additional product use research for many of the non-metallic mineral investigations.

Non-metallic Minerals
Non-metallic, industrial minerals, and construction materials are the principal mineral products of the province; they were valued at more than $210 million in 1987. To support and enhance this part of the mining sector, six projects were begun, under the CNSMDA, to inventory and describe resources of aggregates, gypsum and anhydrite, building stone, diatomaceous earth, fillers and extenders, and various other commodities. Through the winter of 1988, colour brochures Nova Scotia's industrial mineral commodities were prepared for an important international meeting in Boston.

Additional sources of aggregate are being sought for the northwestern part of the province where supply is diminishing and land use conflicts may alienate reserves. Work on the Aggregate Resources Project is describing current reserves and focussing work on the definition of new aggregate deposits.

Gypsum and anhydrite have long been important mineral commodities in the province. The work of the Gypsum and Anhydrite Project will result in a comprehensive inventory of gypsum and anhydrite, and in new uses for the commodities. Extensive field work and detailed examination of drill core have increased the understanding of quality and quantity of gypsum and anhydrite. Experimentation with anhydrite in coal mine roadside packing systems for roof support is underway with co-operation from the Cape Breton Development Corporation.

With the restoration of Province House (the legislature), attention has been focussed on the building stone resources of the province. Many sandstone and granite deposits have been drilled to determine the characteristics of the rock. Several hundred thousand tonnes of sandstone reserves have been outlined by this drilling. Near Halifax, samples of granite were taken to test their suitability for cladding panels, street curbing and a finished monument. Some of the granite deposits are suitable for use as crushed rock.

Several projects are examining the possibility of developing other non-metallic resources for industrial uses of diatomaceous earth, limestone and marble. Work on the Diatomaceous Earth Project has resulted in the description of the quality and quantity for all large deposits in the province. Beginning with a market survey of local needs, the Fillers and Extenders Project has focussed on the large deposits of high-quality limestone and marble in Cape Breton. Another project, Various Commodities, was initiated to update and increase the data base for other industrial mineral commodities that occur throughout Nova Scotia. Silica, limestone and dolomite resources are currently being investigated, in addition to alumina, mica, titanium-rich sands, graphite, and by-products of present and past mining operations.

Metallic Minerals

The great interest in Nova Scotia gold deposits has provided the impetus for further research into the detailed geology of specific gold deposits (Forest Hill, Beaver Dam and Tangier), the stratigraphy, structure and metamorphism of the Meguma Group host rocks, and relationships between ore forming solutions and plutonism. The improved understanding of gold mineralization by geologists in the Meguma Gold Project has allowed them to be of assistance to exploration companies. Another project, the Gold Resource Project, has provided a wealth of information about grade and tonnages, mining methods, and geometry of ore veins and shoots, from historical research into mining areas.

The Base Metals Deposits Project is concerned with improving the understanding of mineral deposits of base metals, tin, tungsten, and other metallic commodities. During 1987, most of the work has been concentrated on the former Walton Mine Cu-Pb-Zn-Ag deposit and the former Yava Mine Pb-Zn-Ag deposit. Study of the Walton deposit provided direct support for concurrent private sector exploration for additional metallic resources at depth.

The Metallotectonic Project combines data from mineral deposit investigations and regional mapping, for the preparation of thematic maps linking metallogeny and plate tectonics. Emphasis in 1987 was on mapping the mineral occurrences in the north central part of the province, and the tectonic classification of igneous rocks.

Regional Mapping

A wide scope of investigations are being completed, from regional mapping of granitic rocks to an evaluation of the stratigraphy, sedimentology and mineral resources of sedimentary basins. The largest of these, the South Mountain Batholith Project, is designed to map the surficial deposits and bedrock of the granite batholith from Halifax to Yarmouth. At present, over half of the batholith is mapped at a scale of 1:50 000 for bedrock and surficial coverage. The bedrock mapping has allowed the batholith to be subdivided into eight intrusive units. Investigation of rock and till geochemistry has outlined areas of mineralization and specialized granitic plutons.

During the summer of 1987, no new field work was initiated but geologists in the Project prepared maps and reports for publication and planned the remaining work on the project. Some of the granite related mineral occurrences discovered in project mapping, or known from previous work, were investigated in more detail during the 1987 field season. Mapping and examination of the East Kemptville tin deposit was also completed in 1987.

Another granite related project is the mapping of the Liscomb Complex in the northern part of southern Nova Scotia. This project is investigating the role of metamorphic fluids and plutonism in the metallogeny of the Meguma Zone.

The Cumberland Basin Project involves the regional mapping of Early and Late Carboniferous strata in northern Nova Scotia. The region has known reserves of coal, gypsum, limestone, and salt and potential for base metals, potash, uranium and precious metals. Associated with this work is the detailed mapping of the Pugwash salt mine, to understand the process of salt diapirism and the potential for other resources such as potash.

Parts of the Cumberland Basin coal deposits at Springhill, Joggins and River Hebert were mapped and examined. The sedimentology and stratigraphy of former coal producing areas is being investigated to assist in predicting where other coal resources may be found. The project is being helped by a seismic survey operated by the Geological Survey of Canada (GSC).

Another sedimentology project involves the study of channel sandstone beds on the roof of the Hub Seam, Prince Colliery, Cape Breton Island. With a better understanding of the roof geometry, the colliery can be operated more efficiently and safely.

Geochemistry and Quaternary Studies
Compilation of a thematic Quaternary geology map was started in Spring of 1987. It will draw on data from previous provincial surveys as well as current CNSMDA-supported mapping by the GSC.

During the summer of 1987, collection of stream sediment and water samples continued as part of the Regional Reconnaissance Geochemical Project. At present, all of northern Nova Scotia and Cape Breton Island has been covered. The objective of the work has been to provide analyses of 28 elements from heavy mineral separates and stream water, to support preparation of the Nova Scotia Geochemical Atlas.

Regional lake sediment geochemistry has indicated new areas of gold potential within previously disregarded granitoid rocks of the Meguma Zone. Some of these areas are receiving follow-up geochemical study to investigate the occurrence and nature of anomalous gold values.

Services to Industry and the Public
The Department maintains a regional office at Stellarton with a library, core storage facilities and core library. During 1987 a fourth building was completed in the Stellarton Core Library complex and significant volumes of valuable diamond-drill core were accommodated as a long-term information resource. Private sector exploration activities are monitored from this office.

Large data bases, including GEOSCAN, are available for use. The information covers bibliographic data, mineral occurrences, drill hole information and coal geology. A new comprehensive bibliography on gold was published and will assist exploration companies to gather additional information about the gold deposits in the province.

The Mineral Land Use Policy Development Project is providing information needed to formulate policy that will ensure the protection, conservation and proper management of energy and mineral resources. Mineral Resource Land Use (MRLU) maps and accompanying handbooks are now available for the Halifax region.

The Education and Public Awareness Program promotes an understanding of the geology, minerals, and mineral industry in Nova Scotia, and the programs and importance of the CNSMDA. Prospecting courses, displays, seminars, interpretive walks, publications, and educational materials for schools are part of the program.

CONCLUSION
The 29 geoscience projects described here are supporting and encouraging mineral exploration and strengthening the province's mineral industry through the CNSMDA. The steady growth of industrial minerals, coal, aggregates and tin production, along with major gold development projects, has encouraged the exploration and mining sectors. Nova Scotia looks forward to a stable and diversified mineral industry.

PRINCE EDWARD ISLAND DEPARTMENT OF ENERGY AND FORESTRY

ENERGY AND MINERALS BRANCH

INTRODUCTION
The goal of the Prince Edward Island Minerals Branch is to develop the capability to respond effectively to public requests and needs relating to mineral, oil and gas administration. In addition, the branch is striving to become the centre of expertise on the geology of Prince Edward Island and is committed to carrying out essential geological survey activities.

The major focus of attention for the Minerals Branch during the 1987-88 fiscal year was the continuation of a study designed to evaluate the Province's onshore mineral aggregate (sand and gravel) resources. The evaluation study is being conducted under the Canada — Prince Edward Island Mineral Development Subsidiary Agreement.

MINERAL DEVELOPMENT SUBSIDIARY AGREEMENT

On January 7, 1986, representatives from the federal and provincial governments signed a three-year, $300 000 Canada — Prince Edward Island Subsidiary Agreement. The Agreement became effective as of January 2, 1986, and will terminate January 1, 1989. It is being funded on an 80%-20% federal-provincial basis and will be delivered totally by the Province.

The purpose of the Agreement is to carry out programs with the objective of moving the Province closer to self-sufficiency in mineral aggregates. Program I, Onshore Aggregate Resources, will permit a comprehensive, qualitative and, where possible, quantitative analysis of both surficial and bedrock mineral aggregate deposits within the Province. This program will involve the collection and assessment of existing information, aerial photograph interpretation, ground investigation and mapping, and the sampling and testing of selected sites.

Program II, Public Information and Evaluation, will ensure that the results of Program I are transferred to potential developers. It is hoped that such an evaluation will provide potential developers with basic information on the nature, size, and potential for development, of the aggregate resources of the Province.

The 1987-88 fiscal year marked the second or interim phase of the Onshore Aggregate Resources Program. The emphasis of the work undertaken was switched from general reconnaissance to local area and and specific site examination of aggregate deposits. Shallow refraction hammer seismic surveys were used to determine depth from surface to bedrock and potential aggregate deposition conditions. Test pits were dug to correlate seismic results with surface geology. The quality of the excavated material was analyzed. These investigations have extended the boundaries of outlined aggregate deposits in the eastern half of the Province and have helped to refine the shallow refraction hammer seismic survey procedures being used to define aggregate potential.

The third and final phase of the program will be a continuation of the phase two activities, and will cover the remainder of the Province.

NEWFOUNDLAND DEPARTMENT OF MINES
MINERAL DEVELOPMENT DIVISION

INTRODUCTION

The Mineral Development Division of the Newfoundland Department of Mines is responsible for obtaining and disseminating information on the geology and mineral potential of the Province. The Division functions as a geological survey, providing the geoscientific data base necessary for government planning and for efficient mineral exploration by private industry. A review of the status of that data base in the mid-1970s indicated major deficiencies and initiated development of the long-term programs which the Division is currently implementing. These programs include bedrock and surficial mapping, geochemical and geophysical surveys, mineral deposit studies and information services (Figure 1 and Table 1). Much of the Division's work in 1987 was carried out under the Canada - Newfoundland Mineral Development Agreement (1984 - 1989).

GEOLOGICAL MAPPING

The Division continued its 1:50 000 scale mapping program on the island of Newfoundland and its 1:100 000 scale program in Labrador in 1987, completing field work in 12 five-year projects. In

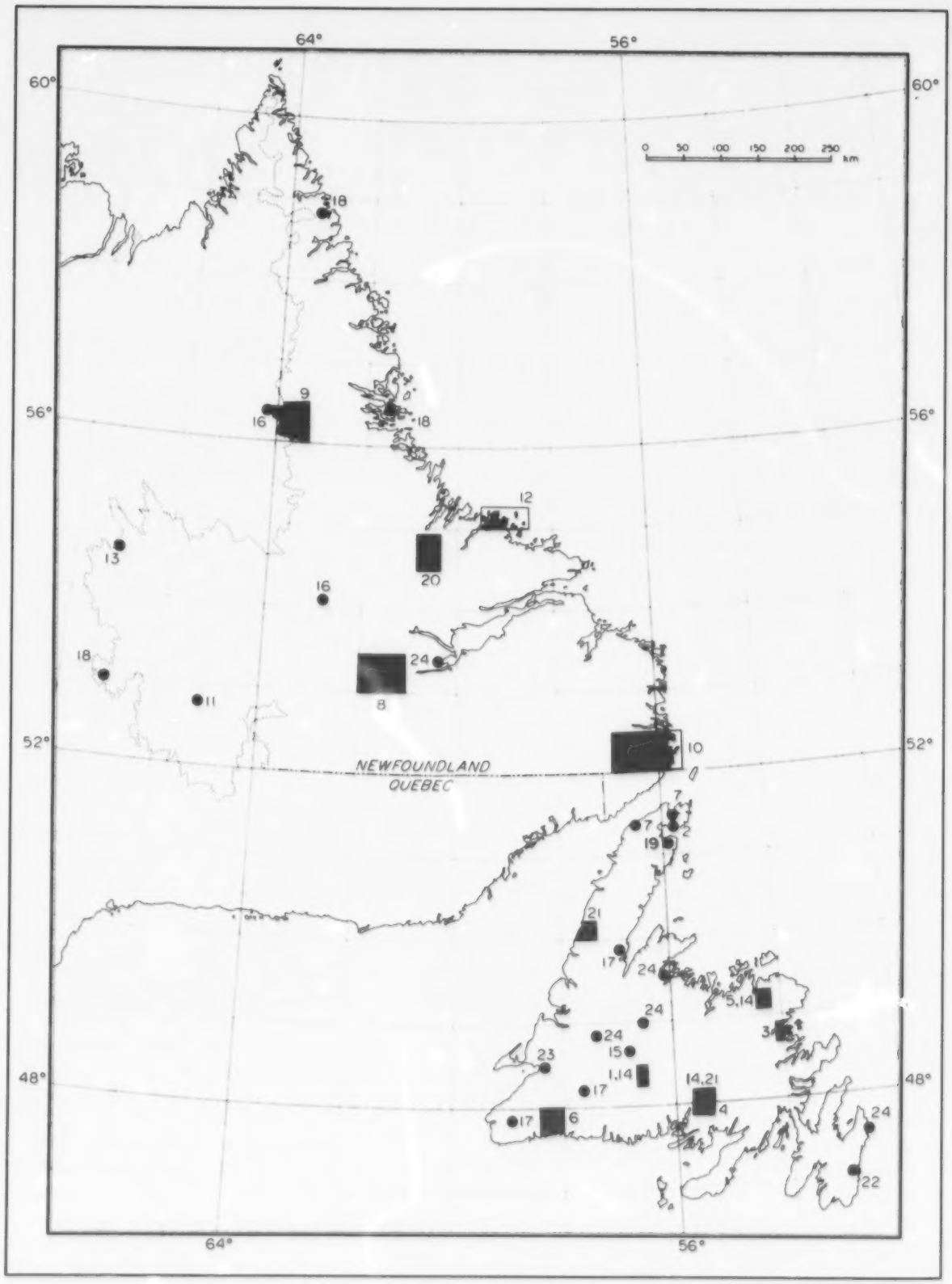


Figure 1. Distribution of field projects, 1987. (Numbers refer to Table 1)

Table 1: Summary of 1987 Field Program
Newfoundland Department of Mines
(Numbers refer to Figure 1)

No.	Project Geologist	Project Name (and scale)	Area
A. Geological Mapping Sections			
1.	S. Colman-Sadd	Bay d'Espoir Project (1:50K)	Snowshoe Pond
2.	I. Knight	Daniel's Harbour Project (1:50K)	Report preparation, field checking
3.	S. O'Brien	Avalon Zone Project (1:50K)	Eastport
4.	L. Dickson	Southern Gander Zone (1:50K)	Hungry Grove Pond
5.	P. O'Neill	Northern Gander Zone (1:50K)	Weirs Pond
6.	B. O'Brien	La Poile Project (1:20K)	Hope Brook
7.	D. Boyce	Biostratigraphic Studies	Boat Harbour
8.	R. Wardle	Central Grenville Project (1:100K)	Goose River
9.	B. Ryan	Strange Lake Project (1:100K)	Kogaluk River
10.	C. Gower	Eastern Grenville Project (1:100K)	Battle Harbour
11.	J. Connelly	Western Grenville Project (1:100K)	Lac Joseph
12.	A. Kerr	Lithogeochemistry of granitoid rocks	Makkovik
B. Geochemistry/Geophysics Section			
13.	J. McConnell	Geochemical exploration methods for gold	Schefferville
14.	G. Kilfoil	Geophysical support - gravity, VLF-EM	Weirs Pond, Snowshoe Pond
C. Mineral Deposits Section			
15.	B. Kean	Metallogeny of volcanogenic sulphide deposits, Victoria Lake area	Red Indian Lake
16.	R. Miller	Metallogeny of Labrador granitoids	Strange Lake, Letitia Lake
17.	J. Tuach	Metallogeny, Newfoundland granitoids	White Bay, Cape Ray
18.	J. Meyer	Assessment of silica and labradorite deposits, Labrador	Labrador City, Nain, Ramah
19.	A. Howse	Assessment of marble and dolomite deposits, western Newfoundland	Roddickton, Corner Brook
D. Quaternary Geology Section			
20.	M. Batterson	Quaternary mapping (1:50K) Central Mineral Belt	Melody Lake
21.	D. Proudfoot	Quaternary mapping (1:50K) Bay d'Espoir	Bay d'Espoir
22.	D. Bragg	Aggregate assessment	Avalon Peninsula
23.	M. Ricketts	Aggregate assessment, development areas	Corner Brook, Springdale, St. Georges
E. Publications and Information Section			
24.	A. Harris	Drill Core Collection & Storage	St. John's, Pasadena, Goose Bay, Buchans, Springdale

Newfoundland, field work was completed in the Snowshoe Pond area (S. Colman-Sadd), on the carbonates of the northern part of the Great Northern Peninsula (I. Knight), in the Weirs Pond area (P. O'Neill), in the southern part of the Gander Zone (L. Dickson), and on the northern Avalon Platform (S. O'Brien). Detailed mapping was carried out in the vicinity of the Hope Brook gold deposit (B. O'Brien). Mapping projects were supported by paleontological and biostratigraphic studies (D. Boyce).

In Labrador, two major 1:100 000 scale mapping transects were completed: one across the Nain and Churchill provinces from the coast to the Quebec border near Strange Lake (B. Ryan); the other, a coastal transect of the Grenville Province from Groswater Bay to the Strait of Belle Isle (C. Gower). J. Connelly completed structural and geochronological studies on the Lac Joseph allochthon in western Labrador, and Andy Kerr completed sampling and mapping of granites in the Makkovik area. R. Wardle continued 1:100 000 scale mapping in the central part of the Grenville Province in Labrador.

Modern geological maps at 1:50 000 scale are now available for 54 percent of the island of Newfoundland; 55 percent of Labrador is covered at 1:100 000 scale.

GEOCHEMISTRY-GEOPHYSICS

The geochemical and geophysical programs consist of regional and detailed field surveys. Regional geochemical coverage of the Province was completed in 1987, with release of the results of lake and stream sediment surveys carried out by the Geological Survey of Canada, under the Canada - Newfoundland Mineral Development Agreement, in northernmost Labrador in 1986. Regional lake sediment data is now available for the entire Province; this data is supplemented by stream sediment coverage in the Torngat Mountains, where lakes are few. Data interpretation and preparation of a 1:1 000 000 scale geochemical atlas of the Province is progressing, under P. Davenport. In detailed studies, J. McConnell continued his investigation of geochemical methods of gold exploration, concentrating this year on the Archean terrane west of Schefferville; his work resulted in the discovery of five new areas of gold mineralization.

The Geological Survey of Canada continued airborne gradiometer and gammaray/VLF-EM surveys under the Canada - Newfoundland Mineral Development Agreement. Gamma-ray surveys were flown over some 12 000 km^2 of the Great Northern Peninsula, and gradiometer coverage was extended to five 1:50 000 scale maps sheets in Notre Dame Bay. Results of gamma-ray surveys flown in 1985 over southeastern Newfoundland were released, as were gradiometer maps for the Victoria Lake area, flown in 1985.

The Division's geophysicist, G. Kilfoil, carried out ground magnetic and VLF-EM surveys in support of bedrock mapping projects in the Weirs Pond, Hungry Grove Pond and Snowshoe Pond areas; surveys were carried out to investigate subsurface orientation of linears, and continuity of surface geology. Refraction seismic and VLF resistivity surveys were carried out in support of overburden thickness studies by geologists of the Quaternary Section.

The geochemical laboratory completed 23 524 determinations on 1836 lake, stream, soil and till samples; 19 341 major oxide determinations on 2017 rock samples; and 27 071 trace element analyses on 2231 samples. The computer unit completed transfer of data to the Division's new in-house computer facility in April; the general government computer facility (NLCS) will henceforth be used for archival and back-up storage only, all the Division's operational needs being met by the in-house unit.

MINERAL DEPOSITS

The Mineral Deposits Section is responsible for metallogenic studies, industrial mineral surveys and mineral inventory. Field work was completed in 1987 on three metallogenic projects which have been ongoing for the past four years: metallogeny of volcanogenic sulphide deposits in the Victoria Lake area (B. Kean), geologic setting and mineralogy of rare earth deposits at Strange Lake and Letitia Lake in Labrador (R. Miller), and metallogeny of gold and tungsten deposits associated with granitoid rocks in western and central Newfoundland (J. Tuach).

In the industrial minerals area, A. Howse continued his assessment of marble deposits in the Roddickton area and initiated a survey of dolostone deposits in western Newfoundland; his work has led to proposals for development of two marble deposits near Roddickton. J. Meyer continued assessment of silica occurrences in Labrador, sampling chert occurrences in Ramah Bay and quartzites of the Sims Formation in western Labrador. Meyer also examined graphite occurrences in Nachvak and Saglek Fiords and investigated lake sediment anomalies, for base and precious metals, in southeastern and northern Labrador.

The mineral inventory project is designed to produce and maintain manual and computerized files, and a 1:250 000 scale mineral occurrence map series, on all mineral occurrences in the Province. The system is in place for about 90 percent of the island of Newfoundland and for 30 percent of Labrador; areas covered in Labrador include the Labrador Trough and the Central Mineral Belt.

QUATERNARY GEOLOGY

Three 1:50 000 scale Quaternary mapping projects were in the field in 1987. M. Batterson continued his work in the eastern part of the Central Mineral Belt of Labrador, completing mapping in the Moran Lake area. D. Proudfoot completed work in the Daniels Harbour area and initiated a new project in Bay d'Espoir. Three mineral aggregate assessment projects were also in the field: M. Ricketts conducted an investigation of aggregate deposits in the St. George's Bay area, to identify deposits with potential for export; D. Bragg surveyed potential bedrock sources of aggregate on the Avalon Peninsula, where unconsolidated deposits are few; and F. Kirby continued his work, within municipal boundaries, to identify aggregate resources for incorporation into municipal plans.

PUBLICATIONS AND INFORMATION

Results of the 1987 program were released in preliminary form at the Division's annual Open House in November, in more formal fashion in Current Research (Report 88-1), and in a number of publications throughout the year.

A. Harris and his staff initiated a pilot project in drill core reduction, examining core from the Carboniferous Deer Lake Basin to test and refine newly developed reduction guidelines.

New core storage facilities were leased at Springdale. Some 60 000 m of core were added in 1987, bringing the total now stored in our five facilities to 247 000 m.

INDIAN AND NORTHERN AFFAIRS CANADA

NORTHWEST TERRITORIES GEOLOGY DIVISION

ACTIVITIES

A major activity of the Division during the year was the development and guidance of the Northwest Territories Mineral Development Agreement (MDA). A co-ordinator and six geologists were hired to conduct mapping and mineral deposit studies. Funding and authorizations did not appear until late fall of 1987 so that only contract projects were undertaken under the MDA in 1987-88. All of these continued into 1988-89 under renewed contracts.

A mapping project planned for the Baffin Region was cancelled because we were unable to hire a qualified project leader. The funds released by this cancellation were in part used to support three new contract projects, with significant mapping components, in and along the margin of the Rankin-Ennadai volcanic belt in the Keewatin District.

The purpose of NWT MDA is to assist mineral resource development in the NWT by:

— accelerating geoscientific mapping so as to expand the geoscience information base, and motivate the private sector to increase exploration and mineral development

— improving efficiency of northern mines, enhancing their ability to compete in the highly competitive world mineral markets

— increasing local awareness of the potential that the mining industry has for providing business and employment opportunities

Discussions with exploration industry representatives generally, and NWT Mineral Exploration Liaison Committee of exploration industry representatives in particular, established that the main area in which the exploration industry feels the NWT Geological data base is lacking is geological maps - particularly in areas of high mineral potential. Industry initially lobbied for 1:50 000 scale, or more detailed, geological mapping. Later, it also lobbied strongly for diversion of expenditures from non-geological mapping projects to 1:250 000 scale geological mapping.

Industry's wish for more and better geological maps, and for metallogenic or mineral deposit mapping, is also apparent in responses to the British Columbia MDA. Perhaps current gold and platinum group metal exploration, for which geological maps appear to be relatively more important, has generated this perceived need. The NWT MDA was designed with this need in mind. The table below shows that the non-contract MDA consists of four 1:50 000 scale mapping components, and two, more detailed, metallogenic and mineral deposit related studies, designed to relate gold deposits to structure and stratigraphy in well-mapped volcanic belts. Seven contracts have been let for detailed geological studies including mapping, and in most cases structural and stratigraphic studies, in areas of significant mineral potential.

In addition to the MDA projects, NWT Geology Division staff continued regional and detailed studies in parts of the NWT where gold exploration is booming. These projects are listed in Table 1, which shows all projects, funded or supported by the Geology Division, which are now underway.

In addition to MDA projects, studies funded by Indian and Northern Affairs Canada (INAC), are also shown in Table 1. Six of these are mapping projects and three are better described as mineral deposit studies. One is designed to date Slave Province rocks as an aid to geological and mineral deposit interpretations.

The first Summer Field Meeting of the Geological Association of Canada, held in Yellowknife in September 1987, was organized and managed by NWT Geology Division staff. A Guidebook to the Yellowknife Mining District was produced for and sold at this meeting.

The 1988 MDA Geoscience Program goal was to run more than thirty geoscience field projects in the NWT. More than half of these are within the Geological Survey of Canada MDA program. The program is on schedule, but the vast majority of the projects are three years in length, and therefore, final results are not expected until the end of the program. Preliminary results will be available by December 1988.

Several Northern Minerals Information Projects (NMIP) have been designed to inform the residents of the NWT of the economic importance of the mining industry. These include two monthly publications, the Mining Newsletter and the Business Opportunities bulletin.

Only one Northern Technology Assistance Project (NTAP) has been accepted. This is the development of an arsenic trioxide recovery technique to recover gold-rich roaster residues stored in abandoned stopes in the Giant Mine.

TABLE 1 — NWT GEOLOGY PROJECTS 1988

PROJECT (Geologist in charge, Liaison)	DESCRIPTION
1. INDIN VOLCANIC BELT Dr. J. Morgan, Dr. W.A. Padgham	Structural and stratigraphic studies to fit the numerous and varied gold deposits of this belt into the geology of the area and to elucidate the relations between the volcanic and sedimentary successions.
2. YELLOWKNIFE VOLCANIC BELT Dr. D. Atkinson, Dr. W.A. Padgham	Structural and stratigraphic studies to fit the numerous and varied gold deposits of this belt into the geology of the area and to elucidate the relations between the volcanic and sedimentary successions.
3. CARP LAKE (85-P) Dr. M. Stubbley Dr.W.A. Padgham	Mapping (1:50 000) of an area of complex geology with potential for various gold, silver and base metal deposits.
4. ARCTIC SOUND (76-N) MARA RIVER (76-K) (Lower Hood-James R.) R. Johnstone, V. Jackson	Mapping (1:50 000) of an area with abundant turbidite sediments that contain Lupin-type (BIF) gold deposits.
5. RIDEOUT ISLAND (76-O) J. Gebert Dr. W.A. Gibbins	Mapping (1:50 000) of an area with abundant volcanic rocks with native silver, VMS and gold potential.
6. TAVANI (55-K) Dr. S. Goff Dr. K. Griep	1:50 000 mapping of areas with abundant, presumably Archean, volcanic rocks (Rankin-Ennadai Volcanic Belt).
7. HEPBURN ISLAND (76-M) KATHAWACHAGA LAKE (76-L) V. Jackson	1:50 000 and 1:250 000 mapping of granite-greenstone terrains.
8. SLEMON LAKE (85 O-4) V. Jackson	1:30 000 mapping of an area of volcanic rocks and sediments with BIF pyrite-pyrrhotite gold deposits in sediments.
9. SLAVE PROVINCE Dr. W.A. Padgham	Collecting material for geochronology and studies of volcanic-sediment relations.
10. REID LAKE (85 I-11) J.B. Seaton	Studies of turbidite-hosted mineral deposits in the western part of the Yellowknife sedimentary domain.
11. KEEWATIN K. Griep	Collecting materials to characterize gold deposits in the Rankin-Ennadai Volcanic Belt.

1 — 6 MDA Projects
7 — 11 NWT Geology Division Projects

CONTRACTS FOR GEOLOGICAL WORK

PROJECT (Status)	CONTRACTOR (Student)
1. Anialik River Area Gold Veins (2nd year)	Dr. E.T.C. Spooner (A. Abraham, Ph.D. res.) U. of Toronto
2. Rare Element Pegmatites in NWT (2nd year)	Dr. P. Cerny (Dr. M. Wise, Paul Tomascak, Ph.D. res.) U. of Manitoba
3. Beniah Lake Area (2nd year)	Dr. W.K. Fyson (D. Roach, Ph.D. res.) U. of Ottawa
4. Gordon Lake Turbidite Hosted Gold-Quartz veins (2nd year)	Drs. Zentilli/Culshaw (T. Stokes, Ph.D. res.) Dalhousie U.
5. Hurwitz Quartzites Sedimentology/Gold Potential (1st year)	Dr. J. Patterson U. of Toronto
6. Study Alkaline Complex and Greenstones Kaminak Lake (1st year)	Dr. F. Cavell U. of Alberta
7. Study of Nonacho Group in Kasba Lake Area (1st year)	Dr. L.B. Aspler
8. Detailed mapping of the volcanic and sedimentary rocks in the Giant Section and correlate results to other problems in the Yellowknife volcanic belt. (2nd year)	Dr. J.A. Donaldson (H. Falck, M.Sc. res.) Carleton U.
9. Study of the Western Plutonic Complex to determine its relevance if any to the shear zone hosted gold deposits at Yellowknife. (3rd year)	Dr. W.S. Fyfe (D. Atkinson, Ph.D. res.) U. of Western Ontario
10. Studies of the Quaternary sediments along the Arctic Coast of the NWT (Paulatuk to Bathurst Inlet). (2nd year)	Dr. N.W. Rutter (D. Kerr, Ph.D. res.) U. of Alberta
11. Geochronological studies in the Slave Province and mapping related to geochronological sampling. (3rd year)	Dr. S.A. Bowring (C. Issachson, Ph.D. res.) Washington Univ. of St. Louis
12. Studies of rare element bearing pegmatites near Chantrey Inlet. (1st year)	Dr. P. Cerny, Dr. M. Wise U. of Manitoba

1 — 7 MDA funded
8 — 12 INAC funded

YUKON DEPARTMENT OF INDIAN AFFAIRS AND NORTHERN DEVELOPMENT
EXPLORATION AND GEOLOGICAL SERVICES DIVISION

INTRODUCTION

The Exploration and Geological Services Division (EGSD) consists of five geologists, an office manager, a map sales manager and a secretary. The Division is part of the Mineral Resources Directorate of the Northern Affairs Program (NAP), along with the Mineral Rights and Mining Engineering divisions. NAP is one of five programs of Indian and Northern Affairs Canada, and in Yukon is responsible for mineral resources management in much the same way as any provincial department of mines. The projects described below were funded either by EGSD, or through the Canada — Yukon Economic Development Agreement (EDA).

GEOLOGY DIVISION PROJECTS — 1987

PERMANENT STAFF PROJECTS	DESCRIPTION
J.A. Morin Chief Geologist	Inventory of Yukon gold and silver deposits. (on change of work location in Vancouver from April 1, 1987 to March 31, 1988)
S.R. Morison Placer Geologist (Acting Chief Geologist)	Mapping and property visits in the Klondike, Sixtymile, Mayo, and Livingstone Creek areas; organized a field excursion as part of the XII Congress of the International Union for Quaternary Research (INQUA), and co-edited and produced the field excursion guidebook
J.G. Abbot Minerals Geologist	Visited most properties under active mining exploration in Yukon; preparing final report on the geology of the Macmillan Pass area
D. Emond Staff Geologist	Visited selected gold and silver occurrences in conjunction with the Morin project; preparing report on tin and tungsten deposits of Mayo-McQuesten District, Yukon
T.J. Bremner Staff Geologist	1:50 000 scale mapping near the Staff Geologist Wellgreen platinum deposit; property scale mapping of Reed Creek, Marsh Lake, and Whitehorse Coal properties

UNIVERSITY THESIS PROJECTS	DESCRIPTION
Mike Power University of Alberta	Microseismicity along the Duke River fault system, southwest Yukon
Peter Von Gaza University of Alberta	Application of remote sensing and digital landform modelling to mineral exploration in the Wheaton and Klondike districts
Alaine Plouffe Carleton University	Feasibility of drift prospecting for gold in the Tintina Trench
John Dickie Dalhousie University	Sedimentology of the Laberge Group near Whitehorse
Steve Johnston University of Alberta	Structural setting of the Aishihik Batholith

CANADA — WEST GERMANY SCIENCE AND TECHNOLOGY EXCHANGE PROGRAM PROJECTS	DESCRIPTION
Frank Böettcher Technical University Aachen, Germany	Heavy minerals of placer gravels in the Klondike District
Karl-Heinz Hoyman Technical University Aachen, Germany	Lithogeochemistry of bedrock, mineralization, and alteration in the Klondike District
Ludwig Stroink Technical University Aachen, Germany	Chemistry and mineralogy of sulphide deposits in the Rancheria District

CANADA — YUKON ECONOMIC DEVELOPMENT AGREEMENT MINERAL RESOURCE SUBAGREEMENT	DESCRIPTION
PROGRAM 1: GEOLOGICAL MAPPING	
A. Doherty, C. Hart, Aurum Geological Consultants Ltd.,	Whitehorse Mapping Project, NTS 105 D/3, 6
D. Murphy, F. Goutier Tesso International Consulting Co.	Rancheria Project, NTS 105 B/7, 8
PROGRAM 2: GEOCHEMICAL SURVEYS	
NTS Map Sheets 105 G, 105 H, 105 M (North Half), 115 P	

1987-1988
GEOLOGICAL PUBLICATIONS
PROVINCIAL AND TERRITORIAL GEOLOGICAL SURVEYS

BRITISH COLUMBIA

INFORMATION CIRCULARS

B.C. Mineral Exploration Review, 1987, Staff, Geological Survey Branch: Information Circular 1988-1.

Where to Get Information and Exploration Data: Information Circular 1988-2.

Publications of the Geological Survey Branch — New Releases and Reprints in 1987-88: Information Circular 1988-3.

MINFILE/vax: Information Circular 1988-4.

MINFILE/pc: Information Circular 1988-5.

White, G.V. and Hora, Z.D., 1988, Dimension Stone in British Columbia: Information Circular 1988-6.

PAPERS

Geological Fieldwork, 1987, Paper 1988-1, contained the following papers:

Legun, A.S., Geology and Coal Resources of the Caribou Creek Map Area, Peace River District (93O 15): Paper 1988-3.

Goodwin, C.I., Gabites, J.E. and Andrew, A., Leadtable: A Galena Lead Isotope DataBase for the Canadian Cordillera, with a Guide to its use by Explorationists: Paper 1988-4.

Hoy, T. and Andrew, K., Preliminary Geology and Geochemistry of the Elise Formation, Rossland Group, Between Nelson and Ymir, Southeastern British Columbia (82F/06).

Brown, D.A. and Logan, J.M., Geology and Mineral Evaluation of Kokanee Glacier Provincial Park, Southeastern British Columbia (82F 11, 14).

Keep, M. and Russell, J.K., Geology of the Avenil Plutonic Complex, Franklin Mining Camp (82E 9).

Johnson, B.J., Progress Report: Stratigraphy and Structure of the Shuswap Metamorphic Complex in the Hunters Range, Eastern Shuswap Highland (82L).

Ray, G.E., Cawson, G.L. and Simpson, R., Geology, Geochemistry, and Metallogenic Zoning in the Hedley Gold-skarn Camp (92H 08; 82E 05).

Massey, N.W.D. and Friday, S.J., Geology of the Chemainus River — Duncan Area, Vancouver Island (92C 16; 92B 13).

Church, B.N., Gaba, R.G., Hanna, M.J. and James, D.A.R., Geological Reconnaissance in the Bridge River Mining Camp (92J 10, 15, 16; 92O 02).

Church, B.N. and James, D.A.R., The Double Derivative Interpretation of Regional Magnetic Fields in the Bridge River Mining Camp (92J 15, 16).

Glover, J.K., Schiarizza, P. and Garver, J.I., Geology of the Noaxe Creek Map Area (92O 02).

Payne, D.F. and Russell, J.K., Geology of the Mount Sheba Igneous Complex (92O 03).

Panteleyev, A., Quesnel Mineral Belt — The Central Volcanic Axis Between Horsefly and Quesnel Lakes (93A 05E, 06W).

Bloodgood, M.A., Geology of the Quesnel Terrane in the Spanish Lake Area, Central British Columbia (93A 11).

Bailey, D.G., Geology of the Central Quesnel Belt, Hydraulic, South-central British Columbia (93A 12).

Diakow, L.J. and Koyanagi, V., Stratigraphy and Mineral Occurrences of Chikamin Mountain and Whitesail Reach Map Areas (93E 06, 10).

Fern, F. and Melville, D.M., Manson Creek Mapping Project (93N 09).

MacIntyre, D.G., and Desjardins, P., Babine Project (93L 15).

Bellefontaine, K.A. and Minehan, K., Summary of Fieldwork in the Ingenika Range, North-central British Columbia (94D 09; 94C 12).

Britton, J.M. and Alldrick, D.J., Sulphurets Map Area (104A 05W, 12W; 104B 08E, 09E).

de Rosen-Spence, A. and Sinclair, A.J., Lower Jurassic Volcanism of the Stikine Superterrane.

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—, AIRBORNE ELECTROMAGNETIC SURVEY TOTAL INTENSITY MAGNETIC SURVEY, WAWA AREA, NTS 42C 7S, ALGOMA DISTRICT. ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 81 006

—, AIRBORNE ELECTROMAGNETIC SURVEY TOTAL INTENSITY MAGNETIC SURVEY, WAWA AREA, NTS 42C 7SE, ALGOMA DISTRICT. ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 81 007

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—, AIRBORNE ELECTROMAGNETIC SURVEY TOTAL INTENSITY MAGNETIC SURVEY, WAWA AREA, NTS 42C 3NW, THUNDER BAY AND ALGOMA DISTRICTS. ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 81 013

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—, AIRBORNE ELECTROMAGNETIC SURVEY TOTAL INTENSITY MAGNETIC SURVEY, WAWA AREA, NTS 42C 2W AND 42C 3E, ALGOMA DISTRICT. ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 81 015

—, AIRBORNE ELECTROMAGNETIC SURVEY TOTAL INTENSITY MAGNETIC SURVEY, WAWA AREA, NTS 42C 2NW AND 42C 7SW, ALGOMA DISTRICT. ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 81 016

—, AIRBORNE ELECTROMAGNETIC SURVEY TOTAL INTENSITY MAGNETIC SURVEY, WAWA AREA, NTS 42C 2NE AND 42C 7SE, ALGOMA DISTRICT. ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 81 017

—, AIRBORNE ELECTROMAGNETIC SURVEY TOTAL INTENSITY MAGNETIC SURVEY, WAWA AREA, NTS 42C 1NW, 42C 2NE, 42C 7SE AND 42C 8SW, ALGOMA DISTRICT. ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 81 018

—, AIRBORNE ELECTROMAGNETIC SURVEY TOTAL INTENSITY MAGNETIC SURVEY, WAWA AREA, NTS 42C 1N AND 42C 8S, ALGOMA DISTRICT. ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 81 019

—, AIRBORNE ELECTROMAGNETIC SURVEY TOTAL INTENSITY MAGNETIC SURVEY, WAWA AREA, NTS 42B 4NW, 42B 5SW, 42C 1NE AND 42C 8S, ALGOMA AND SUDBURY DISTRICTS. ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 81 020

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— AIRBORNE ELECTROMAGNETIC SURVEY TOTAL INTENSITY MAGNETIC SURVEY, WAWA AREA, NTS 41N 13NE, 41N 14NW, 42C 3SW AND 42C 4SE, THUNDER BAY DISTRICT. ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 81 022

—, AIRBORNE ELECTROMAGNETIC SURVEY TOTAL INTENSITY MAGNETIC SURVEY, WAWA AREA, NTS 41N 14NW AND 42C 3SW, THUNDER BAY AND ALGOMA DISTRICTS. ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 81 023

—, AIRBORNE ELECTROMAGNETIC SURVEY TOTAL INTENSITY MAGNETIC SURVEY, WAWA AREA, NTS 41N 14N AND 42C 3S, ALGOMA DISTRICT. ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 81 024

—, AIRBORNE ELECTROMAGNETIC SURVEY TOTAL INTENSITY MAGNETIC SURVEY, WAWA AREA, NTS 41N 14NE, 41N 15NW, 42C 2SW AND 42C 3SE, ALGOMA DISTRICT. ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 81 025

—, AIRBORNE ELECTROMAGNETIC SURVEY TOTAL INTENSITY MAGNETIC SURVEY, WAWA AREA, NTS 41N 15N AND 42C 2S ALGOMA DISTRICT. ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 81 026

—, AIRBORNE ELECTROMAGNETIC SURVEY TOTAL INTENSITY MAGNETIC SURVEY, WAWA AREA, NTS 41N 15NE AND 42C 2SE, ALGOMA DISTRICT. ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 81 027

—, AIRBORNE ELECTROMAGNETIC SURVEY TOTAL INTENSITY MAGNETIC SURVEY, WAWA AREA, NTS 42C 1, ALGOMA DISTRICT. ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 81 028

—, AIRBORNE ELECTROMAGNETIC SURVEY TOTAL INTENSITY MAGNETIC SURVEY, WAWA AREA, NTS 42B 4NW AND 42C 1E, ALGOMA AND SUDBURY DISTRICTS. ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 81 029

—, AIRBORNE ELECTROMAGNETIC SURVEY TOTAL INTENSITY MAGNETIC SURVEY, WAWA AREA, NTS 42B 4NW AND 42B 5SW, SUDBURY DISTRICT. ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 81 030

—, AIRBORNE ELECTROMAGNETIC SURVEY TOTAL INTENSITY MAGNETIC SURVEY, WAWA AREA, NTS 41N 14NW, THUNDER BAY AND ALGOMA DISTRICTS. ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 81 031

—, AIRBORNE ELECTROMAGNETIC SURVEY TOTAL INTENSITY MAGNETIC SURVEY, WAWA AREA, NTS 41N 14N, ALGOMA DISTRICT. ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 81 032

—, AIRBORNE ELECTROMAGNETIC SURVEY TOTAL INTENSITY MAGNETIC SURVEY, WAWA AREA, NTS 41N 15NW AND 42C 2SW, ALGOMA DISTRICT. ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 81 033

—, AIRBORNE ELECTROMAGNETIC SURVEY TOTAL INTENSITY MAGNETIC SURVEY, WAWA AREA, NTS 41N 15NW AND 42C 2SW, ALGOMA DISTRICT. ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 81 034

—, AIRBORNE ELECTROMAGNETIC SURVEY TOTAL INTENSITY MAGNETIC SURVEY, TIMMINS AREA, KIRKLAND TOWNSHIP, NTS 42A/13N, COCHRANE DISTRICT. ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 81 035

—, AIRBORNE ELECTROMAGNETIC SURVEY TOTAL INTENSITY MAGNETIC SURVEY, TIMMINS AREA, KINGSMILL TOWNSHIP, NTS 42A/13NE, COCHRANE DISTRICT. ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 81 036

—, AIRBORNE ELECTROMAGNETIC SURVEY TOTAL INTENSITY MAGNETIC SURVEY, TIMMINS AREA, AUBIN TOWNSHIP, NTS 42A/13NE AND 42A/14NW, COCHRANE DISTRICT. ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 81 037

—, AIRBORNE ELECTROMAGNETIC SURVEY TOTAL INTENSITY MAGNETIC SURVEY, TIMMINS AREA, NESBITT TOWNSHIP, NTS 42A/14NW, COCHRANE DISTRICT. ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 81 038

—, AIRBORNE ELECTROMAGNETIC SURVEY TOTAL INTENSITY MAGNETIC SURVEY, TIMMINS AREA, BECK TOWNSHIP, NTS 42A/14N, COCHRANE DISTRICT. ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 81 039

—, AIRBORNE ELECTROMAGNETIC SURVEY TOTAL INTENSITY MAGNETIC SURVEY, TIMMINS AREA, REAUME TOWNSHIP, NTS 42A/14NE, COCHRANE DISTRICT. ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 81 040

—, AIRBORNE ELECTROMAGNETIC SURVEY TOTAL INTENSITY MAGNETIC SURVEY, TIMMINS AREA, HANNA TOWNSHIP, NTS 42A/14NE AND 42A/15NW, COCHRANE DISTRICT: ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 81 041

—, AIRBORNE ELECTROMAGNETIC SURVEY TOTAL INTENSITY MAGNETIC SURVEY, TIMMINS AREA, ST JOHN TOWNSHIP, NTS 42A/15NW, COCHRANE DISTRICT: ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 81 042

—, AIRBORNE ELECTROMAGNETIC SURVEY TOTAL INTENSITY MAGNETIC SURVEY, TIMMINS AREA, WILHELMINA TOWNSHIP, NTS 42A/13, COCHRANE DISTRICT: ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 81 043

—, AIRBORNE ELECTROMAGNETIC SURVEY TOTAL INTENSITY MAGNETIC SURVEY, TIMMINS AREA, GEARY TOWNSHIP, NTS 42A/13E, COCHRANE DISTRICT: ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 81 044

—, AIRBORNE ELECTROMAGNETIC SURVEY TOTAL INTENSITY MAGNETIC SURVEY, TIMMINS AREA, MAHAFFY TOWNSHIP, NTS 42A/13E AND 42A/14W, COCHRANE DISTRICT: ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 81 045

—, AIRBORNE ELECTROMAGNETIC SURVEY TOTAL INTENSITY MAGNETIC SURVEY, TIMMINS AREA, CRAWFORD TOWNSHIP, NTS 42A/14W, COCHRANE DISTRICT: ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 81 046

—, AIRBORNE ELECTROMAGNETIC SURVEY TOTAL INTENSITY MAGNETIC SURVEY, TIMMINS AREA, LUCAS TOWNSHIP, NTS 42A/14, COCHRANE DISTRICT: ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 81 047

—, AIRBORNE ELECTROMAGNETIC SURVEY TOTAL INTENSITY MAGNETIC SURVEY, TIMMINS AREA, DUFF TOWNSHIP, NTS 42A/14E, COCHRANE DISTRICT: ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 81 048

—, AIRBORNE ELECTROMAGNETIC SURVEY TOTAL INTENSITY MAGNETIC SURVEY, TIMMINS AREA, MANN TOWNSHIP, NTS 42A/14E AND 42A/15W, COCHBANE DISTRICT: ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 81 049

—, AIRBORNE ELECTROMAGNETIC SURVEY TOTAL INTENSITY MAGNETIC SURVEY, TIMMINS AREA, NEWMARKET TOWNSHIP, NTS 42A/15W, COCHRANE DISTRICT: ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 81 050

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—, AIRBORNE ELECTROMAGNETIC SURVEY TOTAL INTENSITY MAGNETIC SURVEY, TIMMINS AREA, CARNEGIE TOWNSHIP, NTS 42A/11NW AND 42A/14SW, COCHRANE DISTRICT: ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 81 054

—, AIRBORNE ELECTROMAGNETIC SURVEY TOTAL INTENSITY MAGNETIC SURVEY, TIMMINS AREA, PROSSER TOWNSHIP, NTS 42A/11N AND 42A/14S, COCHRANE DISTRICT: ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 81 055

—, AIRBORNE ELECTROMAGNETIC SURVEY TOTAL INTENSITY MAGNETIC SURVEY, TIMMINS AREA, TULLY TOWNSHIP, NTS 42A/11NE AND 42A/14SE, COCHRANE DISTRICT: ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 81 056

—, AIRBORNE ELECTROMAGNETIC SURVEY TOTAL INTENSITY MAGNETIC SURVEY, TIMMINS AREA, LITTLE TOWNSHIP, NTS 42A/10NW, 42A/11NE, 42A/14SE AND 42A/15SW, COCHRANE DISTRICT: ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 81 057

—, AIRBORNE ELECTROMAGNETIC SURVEY TOTAL INTENSITY MAGNETIC SURVEY, TIMMINS AREA, MCCART TOWNSHIP, NTS 42A/10NW AND 42A/15SW, COCHRANE DISTRICT: ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 81 058

—, AIRBORNE ELECTROMAGNETIC SURVEY TOTAL INTENSITY MAGNETIC SURVEY, TIMMINS AREA, BYERS TOWNSHIP, NTS 42A/12N, COCHRANE DISTRICT: ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 81 059

—, AIRBORNE ELECTROMAGNETIC SURVEY TOTAL INTENSITY MAGNETIC SURVEY, TIMMINS AREA, LOVELAND TOWNSHIP, NTS 42A/12NE, COCHRANE DISTRICT: ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 81 060

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—, AIRBORNE ELECTROMAGNETIC SURVEY TOTAL INTENSITY MAGNETIC SURVEY, TIMMINS AREA, KIDD TOWNSHIP, NTS 42A/11NW, COCHRANE DISTRICT: ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 81 062

—, AIRBORNE ELECTROMAGNETIC SURVEY TOTAL INTENSITY MAGNETIC SURVEY, TIMMINS AREA, WARK TOWNSHIP, NTS 42A/11N, COCHRANE DISTRICT: ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 81 063

—, AIRBORNE ELECTROMAGNETIC SURVEY TOTAL INTENSITY MAGNETIC SURVEY, TIMMINS AREA, GOWAN TOWNSHIP, NTS 42A/11NE, COCHRANE DISTRICT: ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 81 064

—, AIRBORNE ELECTROMAGNETIC SURVEY TOTAL INTENSITY MAGNETIC SURVEY, TIMMINS AREA, EVELYN TOWNSHIP, NTS 42A/10NW AND 42A/11NE, COCHRANE DISTRICT: ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 81 065

—, AIRBORNE ELECTROMAGNETIC SURVEY TOTAL INTENSITY MAGNETIC SURVEY, TIMMINS AREA, DUNDONALD TOWNSHIP, NTS 42A/10NW, COCHRANE DISTRICT: ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 81 066

—, AIRBORNE ELECTROMAGNETIC SURVEY TOTAL INTENSITY MAGNETIC SURVEY, TIMMINS AREA, COTE TOWNSHIP, NTS 42A/12S, COCHRANE DISTRICT: ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 81 067

—, AIRBORNE ELECTROMAGNETIC SURVEY TOTAL INTENSITY MAGNETIC SURVEY, TIMMINS AREA, ROBB TOWNSHIP, NTS 42A/12SE, COCHRANE DISTRICT: ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 81 068

—, AIRBORNE ELECTROMAGNETIC SURVEY TOTAL INTENSITY MAGNETIC SURVEY, TIMMINS AREA, JAMIESON TOWNSHIP, NTS 42A/11SW AND 42A/12SE, COCHRANE DISTRICT: ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 81 069

—, AIRBORNE ELECTROMAGNETIC SURVEY TOTAL INTENSITY MAGNETIC SURVEY, TIMMINS AREA, JESSOP TOWNSHIP, NTS 42A/11SW, COCHRANE DISTRICT: ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 81 070

—, AIRBORNE ELECTROMAGNETIC SURVEY TOTAL INTENSITY MAGNETIC SURVEY, TIMMINS AREA, MURPHY TOWNSHIP, NTS 42A/11S, COCHRANE DISTRICT: ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 81 071

—, AIRBORNE ELECTROMAGNETIC SURVEY TOTAL INTENSITY MAGNETIC SURVEY, TIMMINS AREA, HOYLE TOWNSHIP, NTS 42A/11SE, COCHRANE DISTRICT: ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 81 072

—, AIRBORNE ELECTROMAGNETIC SURVEY TOTAL INTENSITY MAGNETIC SURVEY, TIMMINS AREA, MATHESON TOWNSHIP, NTS 42A/10SW AND 42A/11SE, COCHRANE DISTRICT: ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 81 073

—, AIRBORNE ELECTROMAGNETIC SURVEY TOTAL INTENSITY MAGNETIC SURVEY, TIMMINS AREA, GERMAN TOWNSHIP, NTS 42A/10SW, COCHRANE DISTRICT: ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 81 074

—, AIRBORNE ELECTROMAGNETIC SURVEY TOTAL INTENSITY MAGNETIC SURVEY, TIMMINS AREA, MASSEY TOWNSHIP, NTS 42A/5N AND 42A/12S, COCHRANE DISTRICT: ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 81 075

—, AIRBORNE ELECTROMAGNETIC SURVEY TOTAL INTENSITY MAGNETIC SURVEY, TIMMINS AREA, TURNBULL TOWNSHIP, NTS 42A/5NE AND 42A/12SE, COCHRANE DISTRICT: ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 81 076

—, AIRBORNE ELECTROMAGNETIC SURVEY TOTAL INTENSITY MAGNETIC SURVEY, TIMMINS AREA, GODFREY TOWNSHIP, NTS 42A/5NE, 42A/6NW, 42A/11SW AND 42A/12SE, COCHRANE DISTRICT: ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 81 077

—, AIRBORNE ELECTROMAGNETIC SURVEY TOTAL INTENSITY MAGNETIC SURVEY, TIMMINS AREA, MOUNTJOY TOWNSHIP, NTS 42A/6 AND 42A/11, DISTRICTS OF COCHRANE AND TIMISKIMING: ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 81 078

—, AIRBORNE ELECTROMAGNETIC SURVEY TOTAL INTENSITY MAGNETIC SURVEY, TIMMINS AREA, TISDALE TOWNSHIP, NTS 42A/6N AND 46A/11S, COCHRANE DISTRICT: ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 81 079

—, AIRBORNE ELECTROMAGNETIC SURVEY TOTAL INTENSITY MAGNETIC SURVEY, TIMMINS AREA, WHITNEY TOWNSHIP, NTS 42A/6NE AND 46A/11SE, COCHRANE DISTRICT: ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 81 080

—, AIRBORNE ELECTROMAGNETIC SURVEY TOTAL INTENSITY MAGNETIC SURVEY, TIMMINS AREA, CODY TOWNSHIP, NTS 42A/6NE, 42A/7NW, 42A/10SW AND 46A/11SE, COCHRANE DISTRICT: ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 81 081

—, AIRBORNE ELECTROMAGNETIC SURVEY TOTAL INTENSITY MAGNETIC SURVEY, TIMMINS AREA, MACKLEM TOWNSHIP, NTS 42A/7NW AND 46A/11SE, COCHRANE DISTRICT: ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 81 082

—, AIRBORNE ELECTROMAGNETIC SURVEY TOTAL INTENSITY MAGNETIC SURVEY, TIMMINS AREA, WHITESIDES TOWNSHIP, NTS 42A/5N, COCHRANE DISTRICT: ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 81 083

—, AIRBORNE ELECTROMAGNETIC SURVEY TOTAL INTENSITY MAGNETIC SURVEY, TIMMINS AREA, CARSCALLEN TOWNSHIP, NTS 42A/5NE, COCHRANE DISTRICT: ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 81 084

—, AIRBORNE ELECTROMAGNETIC SURVEY TOTAL INTENSITY MAGNETIC SURVEY, TIMMINS AREA, BRISTOL TOWNSHIP, NTS 42A/5NE AND 42A/6NW, COCHRANE DISTRICT: ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 81 085

—, AIRBORNE ELECTROMAGNETIC SURVEY TOTAL INTENSITY MAGNETIC SURVEY, TIMMINS AREA, OGDEN TOWNSHIP, NTS 42A/6NW, COCHRANE DISTRICT: ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 81 086

—, AIRBORNE ELECTROMAGNETIC SURVEY TOTAL INTENSITY MAGNETIC SURVEY, TIMMINS AREA, DELORO TOWNSHIP, NTS 42A/6N, COCHRANE DISTRICT: ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 81 087

—, AIRBORNE ELECTROMAGNETIC SURVEY TOTAL INTENSITY MAGNETIC SURVEY, TIMMINS AREA, SHAW TOWNSHIP, NTS 42A/6NE, COCHRANE DISTRICT: ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 81 088

—, AIRBORNE ELECTROMAGNETIC SURVEY TOTAL INTENSITY MAGNETIC SURVEY, TIMMINS AREA, CARMAN TOWNSHIP, NTS 42A/6NE AND 42A/7NW, COCHRANE DISTRICT: ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 81 089

—, AIRBORNE ELECTROMAGNETIC SURVEY TOTAL INTENSITY MAGNETIC SURVEY, TIMMINS AREA, THOMAS TOWNSHIP, NTS 42A/7NW, COCHRANE DISTRICT: ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 81 090

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—, AIRBORNE ELECTROMAGNETIC SURVEY TOTAL INTENSITY MAGNETIC SURVEY, TIMMINS AREA, DENTON TOWNSHIP, NTS 42A/5SW, COCHRANE DISTRICT: ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 81 092

—, AIRBORNE ELECTROMAGNETIC SURVEY TOTAL INTENSITY MAGNETIC SURVEY, TIMMINS AREA, THORNELOE TOWNSHIP, NTS 42A/5SW AND 42A/6SE, COCHRANE DISTRICT: ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 81 093

—, AIRBORNE ELECTROMAGNETIC SURVEY TOTAL INTENSITY MAGNETIC SURVEY, TIMMINS AREA, PRICE TOWNSHIP, NTS 42A/6SW, COCHRANE DISTRICT: ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 81 094

—, AIRBORNE ELECTROMAGNETIC SURVEY TOTAL INTENSITY MAGNETIC SURVEY, TIMMINS AREA, ADAMS TOWNSHIP, NTS 42A/6S, COCHRANE DISTRICT: ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 81 095

—, AIRBORNE ELECTROMAGNETIC SURVEY TOTAL INTENSITY MAGNETIC SURVEY, TIMMINS AREA, ELDORADO TOWNSHIP, NTS 42A/6SE, COCHRANE DISTRICT: ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 81 096

—, AIRBORNE ELECTROMAGNETIC SURVEY TOTAL INTENSITY MAGNETIC SURVEY, TIMMINS AREA, LANGMUIR TOWNSHIP, NTS 42A/6SE AND 42A/7SW, COCHRANE DISTRICT: ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 81 097

—, AIRBORNE ELECTROMAGNETIC SURVEY TOTAL INTENSITY MAGNETIC SURVEY, TIMMINS AREA, BLACKSTOCK TOWNSHIP, NTS 42A/7SW, COCHRANE DISTRICT: ONTARIO GEOLOGICAL SURVEY, GEOPHYSICAL-GEOCHEMICAL SERIES MAP 81 098

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—, QUATERNARY GEOLOGY, LAKE JOSEPH-SANS SOUCI AREA, NTS 31E/4 AND 41H/1E, PARRY SOUND AND MUSKOKA DISTRICTS: ONTARIO GEOLOGICAL SURVEY, MAP P-3103

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—, Sample location map for regional stream sediment and water geochemical reconnaissance survey, southern New Brunswick (parts of NTS 21 G/1,8, 21 H/4,5,12), scale 1:100 000: New Brunswick Department of Natural Resources and Energy, Minerals and Energy Division, Plate 87-22B.

—, Copper (ppm), regional stream sediment and water geochemical reconnaissance survey, southern New Brunswick (parts of NTS 21 H/6,10,11,14,15), scale 1:100 000: New Brunswick Department of Natural Resources and Energy, Minerals and Energy Division, Plate 87-23A.

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—, Lead (ppm), regional stream sediment and water geochemical reconnaissance survey, southern New Brunswick (parts of NTS 21 H/6,10,11,14,15), scale 1:100 000: New Brunswick Department of Natural Resources and Energy, Minerals and Energy Division, Plate 87-24A.

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—, Zinc (ppm), regional stream sediment and water geochemical reconnaissance survey, southern New Brunswick (parts of NTS 21 H/6,10,11,14,15), scale 1:100 000: New Brunswick Department of Natural Resources and Energy, Minerals and Energy Division, Plate 87-25A.

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—, Antimony (ppm), regional stream sediment and water geochemical reconnaissance survey, southern New Brunswick (parts of NTS 21 H/6,10,11,14,15), scale 1:100 000: New Brunswick Department of Natural Resources and Energy, Minerals and Energy Division, Plate 87-28A.

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—, Tungsten (ppm), regional stream sediment and water geochemical reconnaissance survey, southern New Brunswick (parts of NTS 21 H/6,10,11,14,15), scale 1:100 000: New Brunswick Department of Natural Resources and Energy, Minerals and Energy Division, Plate 87-29A.

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—, Molybdenum (ppm), regional stream sediment and water geochemical reconnaissance survey, southern New Brunswick (parts of NTS 21 H/6,10,11,14,15), scale 1:100 000: New Brunswick Department of Natural Resources and Energy, Minerals and Energy Division, Plate 87-30A.

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—, Cobalt (ppm), regional stream sediment and water geochemical reconnaissance survey, southern New Brunswick (parts of NTS 21 H/6,10,11,14,15), scale 1:100 000: New Brunswick Department of Natural Resources and Energy, Minerals and Energy Division, Plate 87-32A.

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—, Nickel (ppm), regional stream sediment and water geochemical reconnaissance survey, southern New Brunswick (parts of NTS 21 H/6,10,11,14,15), scale 1:100 000: New Brunswick Department of Natural Resources and Energy, Minerals and Energy Division, Plate 87-34A.

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SURVEY OF FEDERAL—PROVINCIAL MINERAL DEVELOPMENT AGREEMENTS

Province or Territory	Total $ Value of Agreement ($ million)	Cost Sharing Formula	Time Period	Delivery % Canada % Province	Major Components/Projects			Contact Person & Tel. No.
					Project Name	Budget ($,000's)	Delivery (Prov. or Canada)	
British Columbia	$10	50/50	1985-1990	96% B.C. 4% Can.	Geoscientific Surveys	6 650	90% B.C.	G. McKilop (604) 356-2854
					Geoscience Data Systems	450	94% B.C.	
					Market, Technical & Feasibility Studies	1 250	100% B.C.	
					Financial Assist. for Mine Development	1 120	100% B.C.	
					Management, Public Info., Evaluation	530	100% B.C.	
Saskatchewan	$6 380	N/A	1984-1989	50 Can. 50 Sask. Parallel Work Delivery	**Geoscience**	5 340	41.2 Can. 51.8 Sask.	R. Macdonald (306) 787-2568
					Minerals Technology	400	100 Can.	
					Mineral Development	400	100 Can.	
					Public Information	240	79.2 Can. 20.8 Sask.	
Manitoba	$24.7	60% Fed. 40% Prov.	1984-89	60% Can. 40% Man.	Sector A Geoscientific Activities	13 000	38.5% Man.	W.D. McRitchie (204) 945-6559
					Sector B Research & Technology	7 430	37.2% Man.	
					Sector C Development Studies	1 770	50% Man.	
					Sector D Public Information, Evaluation and Administration	2 500	50% Man.	
Ontario	$30	50/50	1935-1990	63% Ont. 37% Can.	Geoscience Program Information Exchange	18 350	64% Ont. 100% Ont.	R. Watson (416) 965-1546
					Productivity & Technology	3 550	100% Ont.	
					Economic Development	4 500	96% Ont.	
					Public Information, Evaluation and Administration			
Québec	$100	50/50	1985-1990	96% Qué. 4% Can.	5 Volets			
					1. Activités géoscientifiques	34 750	Québec	J.L. Caty 643-1803
					2. Recherche et développement sur l'amiante	8 000	Québec-Canada	à déterminer
					3. Infrastructure de développement minéral	42 000	Québec	A. Jean 643-4896
					4. Désenclavement de l'industrie québécoise du mineral de fer	15 000	Québec	G. Richard 643-4410
					5. Information au public	250	Québec	M. Lecours 643-1803

SURVEY OF FEDERAL—PROVINCIAL MINERAL DEVELOPMENT AGREEMENTS

Province or Territory	Total $ Value of Agreement ($ million)	Cost Sharing Formula	Time Period	Delivery % Canada % Province	Major Components/Projects			
					Project Name	Budget ($,000's)	Delivery (Prov. or Canada)	Contact Person & Tel. No.
New Brunswick	$22.3	—	1984-1989	30% N.B. 60% Can.	GEOSCIENCE	12 373	31% N.B.	ADM- R.R. Potter North- J.J. Davis Central- L.R. Fyffe South- A.A. Ruitenberg GSC- F.D. Anderson W.H. Poole
					MINING & MINERALS TECH.	3 275	8% N.B.	G. Greer or D. Barnett (506) 4530-2206
					ECONOMIC DEVELOPMENT	4 861	57% N.B.	G. Greer or D. Barnett
					PUBLIC INFORMATION, EVALUATION, ADMIN.	1 798	16.6% N.B.	D. Carroll (506) 453-2206
Nova Scotia	$26.945	60/40	1984-89	60% Can. 40% N.S.	GEOSCIENCE	14 507	62% Can. 38% N.S.	J.D. Keppie MDA Coord. (902) 424-4700
					MINERAL TECHNOLOGY	4 982	66% Can. 33% N.S.	
					DEVELOPMENT STUDIES	1 841	48% Can. 52% N.S.	
					MINERAL INVESTMENT STIMULATION PROGRAM (MISP)	1 600	80% Can. 20% N.S.	
					PUBLIC INFORMATION	1 215	37% Can. 63% N.S.	
					ADMINISTRATION	2 800	47% Can. 53% N.S.	
Newfoundland	$22	50/50	1984-1989	45% Nfld. 55% Can.	Geoscientific Surveys	16 400	52% Nfld.	B. Greene (709) 576-2763
					Mining & Mineral Tech.	2 100	29% Nfld.	
					Economic Develop. Studies	1 500	17% Nfld.	
					Public Information, Evaluation and Administration	2 000	30% Nfld.	
Prince Edward Island	$0.3	80/20	1986-1989	100% P.E.I.	GEOSCIENCE — Onshore Aggregate Resources	290.6	100% P.E.I.	W. MacQuarrie (902) 368-5011
					— Public Information and Evaluation	9.4	100% P.E.I.	
Yukon Mineral Resources Subagreement	$3.9	90/10 Can./Yukon	1985-1989	100% Can.	1. Geological Mapping	1 100	100% Can. (DIAND)	G.R. Morison (DIAND) (403) 667-3200
					2. Geochemistry	2 200	100% Can. (G.S.C.)	A. Clark (EMR) (613) 995-7789
					3. Placer Mining	600	100% Can. (DIAND)	A. Maroway (DIAND) (403) 667-3153

1988/89 ANNUAL REVIEWS OF ACTIVITIES
PROVINCIAL AND FEDERAL GEOSCIENTIFIC ORGANIZATIONS

Province or Territory Location	Date(s) (No. of Days)	Time for Talks	Universities Involved?	Industry Involved?	Poster Session	Universities Involved?	Industry Involved?	Publication	[1]Energy Matters	[2]Other Topics	Comments
British Columbia Vancouver	8 Feb. 89 (1 of 4)	1 day	Yes	Yes B.C. & Yukon Chamber Annual Meeting	Yes	Yes	Yes	- Geological Fieldwork - B.C. Mineral Exploration Review, 1988	Yes Coal	Yes	Part of "Cordilleran Geology and Exploration Roundup" 7 Feb. - GSC; DIAND-Yukon 8 Feb. - BCEMPR 9, 10 Feb. - BC-YCM
Yukon Territory Whitehorse (DIAND)	27-29 Nov. 88 Whitehorse (2)	2 days	Yes	Yes	Yes 2 days	Yes	Yes	No	No	No	Contributions from DIAND, GSC and industry. Review of current projects
	7 Feb. 89 Vancouver (1 of 4)	one 1-hour session	No	No	Yes	Yes	No	No	No	No	Part of "Cordilleran Geology and Exploration Round-Up" with BCEMPR BC-YCM, and GSC
Northwest Territories Yellowknife (DIAND)	6-8 Dec. 88 (3)	3 days	Yes	Yes	Concurrent Dec. 6-8	Yes	Yes	Exploration, Mining and Geology overview	Coal only	as required	Organized with NWT Chamber of Mines GSC involved. Also take part in "Cordilleran Geology and Exploration Round-Up", Vancouver
Alberta Calgary	8 Nov. 88 (1)	0.5 day	No	No	1 day	No	Yes	Alta. Geol. Survey Res. Forum - 88	Yes	No	Held bi-annually; GSC involved
Saskatchewan Regina	23, 24 Nov. 88 (1)	0.5 day	Yes	No	0.5 day	Yes	Yes	Summary of Investiga-tions	Yes	No	Sask. Research Council involved, talks and poster displays
Manitoba Winnipeg	21, 22 Nov. 88 (1.5)	1 day	Yes	No	1-2 days	Yes	No	Rept. of Field Activities	No	No	Contributions from GSC and University of Manitoba and other universities
Ontario Toronto	12-14 Dec. 88 (2.5)	2.5 days	Yes	Yes	2 days	Yes	No	2 Repts. of Activities	Yes	Yes	GSC involved Research oriented Mineral Dev. Forum
Quebec Quebec City	30 Nov. - 1 Dec. 88 (2)	2 days	Yes	No	2 days	Yes	No	Rept. of Activities	No	No	Special publication of talks presented
New Brunswick Fredericton	14, 15 Nov. 88 (1.5)	1.5 days	Yes	No	1 day	Yes	Yes	1988 Project Resumes	No	Yes	GSC involved
Nova Scotia Halifax	16, 17 Nov. 88 (1.5)	1 day	No	No	1 day	Yes	No	Program and Summaries	Yes	Yes	GSC involved; also symposium, N.S. Chamber of Mineral Resources
Newfoundland St. John's	3 Nov. 88 (1)	1 day	Yes	Yes	0.5 day	Yes	No	Yes	No	Yes	GSC involved
Prince Edward Island Charlottetown	3 May 89 (1)	No	No	No	1 day	No	No	No	Yes	Yes	Mineral, Forestry and Energy matters
Geological Surv. Can. Ottawa	17, 18 Jan. 89 (2)	2 days	Yes	No	2 days	Yes	No	Abstract vol. Current Research	Yes	Yes	Provincial agencies involved

[1] Energy Matters (e.g. oil, gas, coal, oil shales, peat)

[2] Other Topics: (e.g. administration, engineering, regulations, legislation, etc.)

NSDME Nov 88

SURVEY OF HARD ROCK DRILL CORE PROGRAMS IN CANADA, FISCAL YEAR 1987-88

Province	B.C.** (1986)	ALBERTA	SASK.	MAN.	ONT.	QUE.	N.B.	N.S.	NFLD & LAB.	P.E.I.	YUKON	N.W.T.
No. of facilities	1	1	1	4	7	3	3	4	5	1	1	1
Staff-Person Days Work 1987-88	40 days	70	88	409	3 787	nil	330	857	640	—	179	108
Capital Cost 1987-88 ($ × 000)	nil	nil	nil	6.9	24.3	nil	nil	265.0	100.0	—	70.0	3.5
Operating Cost 1987-88 ($ × 000)	$5.0	28.3	17.0	70.0	106.7	46.0	50.0	111.3	118.0	—	12.0	21.3
Core Collected and/or Delivered 1987-88	– m	100 m	6 590 m	4 384 m	98 900	18 515	29 000	15 462	64 540	—	8 339	716
Core Reduction*	nil	nil	nil	2 010 m	6 650	—	nil	166	nil	—	nil	nil
Use of facilities (visits of persons) 1987-88	12	12	99	45 days/ 13 visits	1 515	204	100	266 visits 728 userdays	113	2	25	40
Total Core in Storage (from all years)	150 000 m	19 859	93 043	173 331	622 800	265 428	256 933	435 000	250 468	1 298	107 396	30 048
Total Exploration Drilling 1987-88	4 866 m	3 100	224 748	277 138	534 000	888 000	42 000	205 000	60 000 +	—	57 105	190 240

* Over last year

** Coal core is not hard rock. There are no facilities for hard rock in B.C. — figures are for coal

THE PROSPECTORS AND DEVELOPERS ASSOCIATION OF CANADA ADDRESSES THE COMMITTEE OF PROVINCIAL GEOLOGISTS

A.J. Andrews

The following report summarizes the main points of a Prospectors and Developers Association of Canada presentation to the Committee of Provincial Geologists in Quebec City, August 28, 1988.

INTRODUCTION

Today the exploration and development industry is facing events and circumstances which are causing its members considerable concern. Chief among these are:

a. a significant decrease in Canada's reserves of base metals;

b. a pressing need for new mineral deposits and for grassroots prospecting to find them;

c. a need to search for and extract minerals at greater depths and the associated additional costs and technical challenges that this presents;
and

d. the lackluster condition of the equity markets and the consequent problems associated with the raising of exploration risk capital.

These are the critical factors that are currently affecting our industry. Together they form an equation which, if left unsolved, threatens Canada's competitive position in a world in which international competitiveness is becoming increasingly fierce. It is important to note that the federal government's new Canadian's Exploration Incentive Program (CEIP) is directed almost exclusively to junior mining companies. Since junior companies depend on an existing inventory of previously identified prospects in order to carry on their work of exploration and development, it follows that the level of grassroots prospecting and new discoveries must be maintained and increased in order that CEIP will be put to the best use.

In recognition of this situation the PDAC, in its brief to the Mines Ministers Conference this year, recommended that (a) financial incentives be provided to help maintain prospecting and exploration momentum and (b) a high quality, up-to-date geological database be maintained to help explorationists locate the great mineral wealth yet to be found but so cunningly hidden.

The latter is, of course, where the Geological Surveys will play a critical role.

Mapping

Without a doubt, geological mapping is the most fundamental component in the process of geoscientific data acquisition for exploration purposes. Mapping marks the beginning point of data acquisition and all other activities hinge on this vital information.

It is our perception that there has been a decline in the level of field activities of the Geological Surveys across the country relative to exploration activity and that present levels of field work are not as high as they have been in past years. We speak for our entire industry when we say that there are more benefits for everybody when government geologists are spending their time in the field rather than in the fluid inclusion labs. This is certainly not to diminish the importance of specialized research of this nature. It is simply to suggest that a sensible balance be maintained and that such research be recognized as an adjunct to the fundamental process of mapping.

Last year, the PDAC surveyed its members on the current state of geological mapping in Canada. Responses to the survey brought some specific concerns to light. Here are some of the questions and responses;

«How good is the existing map coverage?»
— 47% of the respondents said that coverage was inadequate and in need of improvement

«Where and how should mapping be conducted?»
— 62% stated that Geological Surveys should maintain a long-term agenda of areas to be mapped but also maintain the flexibility and ability to quickly focus on areas of special economic or scientific interest when the need arises

«What is the desired scale of regional geological maps?»
— 69% answered 1:100,000 or larger

«What is the desired scale of local geological maps?»
— 85% answered in the range of 1:50,000 to 1:25,000

Some of the most common unsolicited remarks focussed on the need to (a) improve on timeliness of publications (b) remap in areas where current maps are outdated (c) do less esoteric work and return to the field (d) reprint out-of-print maps and reports (e) standardize maps across provincial and territorial boundaries.

National Database

We believe that a national perspective is imperative in the acquisition, production and management of geoscientific data. Key words are integration, coordination, compatibility and standardization.

Integration and Standardization of Maps: The industry would like to see information that knows no political bounds. We would welcome the compilation and integration of all Canadian geologica data, be they provincial or federal. The occasional volumes put out by the GSC are excellent references and summaries. However, what is really needed is information put out on a more frequent basis and designed to be of practical use to explorationists. We are talking here of maps produced at a scale geared to exploration and which possess the magical quality of transcending political boundaries.

Our industry would welcome any attempts on the part of the provinces to standardize map legends, symbols and scales. This kind of standardization would be of immense value to explorationists who now have to contend with cross-provincial inconsistencies and differences.

Compatibility and Coordination of Computer Systems: In the not too distant future most geoscientific data will be managed and accessed by computer systems. Indeed some of the provinces have already made significant headway in computer automation, and test projects are currently underway. Compatibility among these automated systems will benefit all of us, and the PDAC urges the individual Geological Surveys to work towards this common goal. Discussion and consideration of compatibility should begin at the conceptual stage of an automated system's design — that is NOW. Compatibility and standardization of computer equipment, software, and procedures will permit information flow from one system to another and will inevitably facilitate use of the systems. At this point, we cannot afford to proceed at different tangents.

Mineral Development Agreements (MDA's)

MDA's have, without exception, proven to be of immense value to our industry. The PDAC, in its brief to the Mines Ministers Conference this year, strongly recommended that these programs be continued and urged the Ministers to support renewal of the program. MDA's have successfully «plugged the gap» between the decrease in provincial and territorial geological field work and the ever present requirement for geological data. But MDA's are finite. As a short term, interim measure, they have achieved much. As a long-term solution, they are no substitute for a firm commitment from federal and provincial governments alike to establish satisfactory levels of geological activities.

Public Image

Perhaps the single most negative influence which affects the exploration and mining industry on a daily basis is our poor public image. Our industry tends to have a low profile and to sit low on the priority list of most government and public agendas. Among the John Does in the street, the bureaucrats in the upper echelons of government, and their political masters, there appears to be a very limited understanding of the contribution our industry makes to the quality of living and to the economy of our country. By many, we are seen merely as polluters of the environment, and as exploiters of precious, limited resources.

The danger here is that this popular perception acts to distort political judgement. It is no secret that there is pressure on politicians to make decisions which are politically safe. If the general view is that exploration and mining are undesirable activities then decisions and policies are likely to reflect this view. Needless to say, these kinds of decisions and policies are more likely to affect us negatively rather than positively and will outweigh any reasonable solutions that our industry proffers.

If the Canadian exploration and mining industry is to remain strong and healthy, we must lobby for government support and the introduction of policies that are at the same time conducive to the industry and the public good. In our view, the most effective way to achieve this is by improving our image and gaining public support for the industry.

To effect such a change is a project of very large proportions and with an unending agenda. It is far too large to be tackled by a single organization. Success will only come with coordinated national effort and cooperation between industry and government. We see government's vital role in this endeavor in the realm of education. The PDAC and The Mining Association of Canada have begun to address the problem and to map out a strategy. A national advisory committee has been struck with the mandate to identify programs and funds to initiate action. We consider that it is of vital importance to the health and wellbeing of our industry and to those associated with it.

TABLES SUMMARIZING MINING RIGHTS LEGISLATION IN THE PROVINCES AND TERRITORIES

These tables were first published in the 1984 edition of the Provincial Geologists Journal. Revised tables were published in 1985. Since then, several provinces have made substantial amendments to their legislation. The current edition incorporates these recent changes.

Mining rights (dispositions) are the legal vehicles through which the owners of the minerals, the Provinces and Canada, grant to the public exclusive rights to search for, develop and mine those minerals.

Figures 1 to 5 are tables of data that summarize selected elements of mining right legislation in the ten provinces and two territories. Elements selected are those that deal with obtaining and maintaining a mining right.

Figures 1, 2 and 3 contain the raw data as specified in each provincial and territorial piece of legislation. The data is organized under the three stages of progression of a mineral showing to a producing mine, i.e. exploration, development and production, with some overlap. These three stages are correlated with the advancing levels of mining rights, as follows:

STAGE	MINING RIGHT
1. exploration and development	claim
2. development and pre-production	licence, late claim or early lease — production not a condition of the lease
3. production	late lease (lease in some provinces) — production generally a condition of the lease

Because of varying claim sizes and use of both Imperial and metric measure, Figures 1 to 3 have limitations in their usefulness for comparisons between jurisdictions, especially with respect to required work and fees. Thus, Figures 4 and 5 have been constructed to provide for direct comparison of these two elements. Part A of Figure 4 repeats the raw data for required work while Part B shows the same data mathematically averaged, based on a 40 acre (16 ha) claim. In Figure 5, the fees for recording and renewing claims are also converted to a 40 acre (16 ha) claim size and licence and lease rentals are expressed as $ per ha per year.

The reader is advised that, because of the on-going process of amendment to legislation, some data may be obsolete by the time of publication of these tables. The reader is also cautioned that these tables are not a substitute for actual legislation nor should they be used as such.

In order to accomplish completeness of data in a convenient size, it is necessary to make considerable use of the following abbreviations and symbols:

ft	feet	L	length
m	metres	W	Width
ac	acres	$> \not>$	greater than, not greater than
yr(s)	year(s)	$< \not<$	less than, not less than
ha	hectares	max	maximum
t	tonnes	min	minimum
mos	months	ug	underground

The tables were prepared by Eugene Jackson, Chief, Mineral Lands, New Brunswick Department of Natural Resources and Energy under the auspices and with the assistance of the Provincial/Territorial Mining Rights Committee. The members of the Committee are listed on the following page.

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Figure 1. Exploration and development

		YUKON	NWT	B.C.	ALBERTA	SASKATCHEWAN
Enacted (last amend)		1952 (1987)	1977 (1987)	1988	1984 (1987)	1986
Ground/map staking		ground	ground	ground	map	ground
Basic claim	**Name**	mineral claim	claim	a) mineral claim of 1 to 20 units b) 2-post claim	metallic minerals exploration permit	claim
	How staked	2 post, line between marked	4 corner posts and at 1500 ft on ext. bndry boundary marked	a) legal corner post and at 500 m on ext. bnbdry, bndry marked b) 2 posts, line between marked	application (map selection)	a) survey area: legal subdivision(s) b) unsurveyed area: 4 corner posts and at 500 m on ext. bndry boundary marked
	Size	L ≯ 1500 feet W ≯ 1500 feet 51.65 ac. (20.9 ha)	≯ 2582.5 acres (= 50 at 1500 feet) sides are mult. of 1500 ft, L ≯ 5W	a) unit: 500 m (25 ha) b) 2-post claim: 500 m (1640 ft) 25 ha (61.78 ac.)	16 to 9216 hectares	16 to 6,000 hectares L ≯ 6W
Block	**Size**			25 to 500 ha. ≯ 8 units in one direc.		
Bearing of boundaries		any	astronomic N-S E-W	a) astronomic N-S E-W b) any	astronomic N-S E-W	any but rectangular in shape
Time marked on No.1 post		date only	placing of post and completion of claim	a) commencement and completion b) date only	N.A	completion
Maximum time to affix tags		as soon as reasonably possible after record.	60 days	when staking (write on tags)	N.A	1 year from recording
Maximum days to record		15 + extra, depends on distance	60	20	N.A	15
Recording fee		$10/claim	$0.10/acre	$5 unit	$450/permit	$0.60/ha, minimum $10
Term length × number		1 yr × unlim.	2 years, plus 1 yr × 8	1 yr × unlim.	3 yrs, plus 2 yrs plus 1 yr + 1 yr	2 yrs, plus 1 yr × unlimited
Renewal fee *Filing work		$5/claim*	$0.10/acre*	$5/$100 work*	none	0
Annual work $/claim unless otherwise specif.		100	yrs (1 + 2) $4/acre 3 + $2/acre	yrs 1-3 100/unit 4 + 200/unit	first term $10/ha second term $20/ha third term $15/ha fourth term $15/ha	yers 2-10 $12/ha yrs 11 + $25/ha
Cash for work — Refund if work done		yes - no	yes - yes	yes - no	Deposit $10/ha Refund - yes	yes - yes
Limit for grouping work		16 claims/yr	5165 ac/yr (= 100 at 1500 ft)	100 claims/yr	1 claim per term	10,000 ha/yr
Limit of excess work		$400/cl/yr	unlim.	10 yrs.	unlim.	unlim.
Time after anniver. to file work reports		6 mos (fee after 14 days)	30 days, 1 yr + 30 days for excess work	90 days	not later than anniversary	90 days
Confidential period for work reports		lapse + 6 mos.	upon lapse or 3 yrs	1 yr	1 yr after term or permit expiry	3 yrs, less by consent or lapse
Production permitted		yes	≯ $100,000/yr	≯ 1000t/yr/unit	no	no
Other exploration rights		—	permit to prospect	reverted Crown-granted claim	none	permit
Prospector's licence		no	yes	yes	no	no

MANITOBA	ONTARIO	QUEBEC	N.B.	N.S.	P.E.I.	NFLD.
1981 (1987)	1906 (1988)	1988	1986 (1988)	1975 (1984)	1978	1983
ground	ground	a) ground b) map S of St. Lawr.	ground	map	map	a) ground b) map
claim	mining claim	claim	mineral claim	claim exploration licence for 1 to 80 claims	claim exploration lic. for 1 to 80 clms	mineral claim
a) surv. area: 1 + leg. subd'ns b) unsurv. area: 4 cor. posts & at 400 m on bndry, bndry marked	4 corner posts in clockwise order boundary marked	a) 4 corner posts, bndry marked, special rules in surveyed area b) map selection	4 corner posts in clockwise order bndry marked	map selection	map selection	a) 4 corner posts bndry marked b) map selection
16 to 256 ha L ≯ 4W side ≯ 400 m	a) 1320 ft (40 ac) in unsurv. areas b) aliquot part of subdivided lot in surv. areas	a) 16 ha (400 m) in unsurv. area; full lot size in surv. area (max. 500 ha) b) same	400 m (16 ha)	40 to 3200 acres	40 to 3200 acres	a) 400 m (16 ha) b) 500 m (25 ha) a) 1 to 64 claims (16 to 1024 ha) L ≯ 4W
any but rectangular in shape	a) astronomic N-S E-W b) variable	astro. in unsurv. area variable otherwise	magnetic N-S E-W	astronomic N-S E-W	astronomic N-S E-W	a) astronomic N-S E-W b) UTM grid
completion	commencement	commencement	completion	N/A	N/A	completion
at staking if prepurch., 1 yr if purch. at rec'ding	6 months from recording	when staking (write on tags)	when staking (write on tags)	N/A	N/A	when staking
30	31	20 days except 30 days N of 52°	21	N/A	N/A	30
$5/claim	$10/claim	≤ 25 ha $20; 25-100 ha $40; > 100 ha $60	$5/claim	$4 claim	$5/claim	a) $5 claim b) $7.50 claim
2 yrs plus 1 yr × unlim.	1 yr × 5	2 yrs × unlim.	1 yr × unlim.	1 yr × 8 (yrs 6, 7, 8 at min. discret)	1 yr × 5	1 yr × 5
$2/claim*	0	same as recording	yrs 1-5 $4; 6-10 $20 11-15 $25; 16 + $30	$4 claim	$5 claim	0
yrs 2-10 $12.50/ha 11 + $25.00/ha	yrs 1 20 days 2-4 40 days 5 60 days	$/2 yr term lms ≤25ha 25-100 ≥100 1-3 500 1200 2000 4-6 750 1800 3000 7+ 1000 2500 4000	yr 1 100 5-10 300 2 150 11-15 500 3 200 16-25 600 4 250 25 + 800	10 days (day = $20)	$5 acre	yr 1 (a)200 (b)300 2 250 375 3 300 450 4 350 525 5 400 600
yes - yes	no	yes under special cond'ns - no	yr 1 $20 - no	yes - yes	yes - yes	yes - yes
1600 ha/yr	4000 days appl'n (more for drilling)	within a 3.2 km sq	unlim.	an expl. licence (80 claims)	an expl. licence (80 claims)	contiguous claims
unlim.	unlim.	unlim.	10 yrs.	unlim.	unlim.	unlim.
60 days	10 days	by annv.; no pnty 60 dys before annv	30 days	15 days	15 days	60 days
none with consent or upon lapse	none	none	max. 2 yrs on request	2 yrs. possible ext'n of 1 yr	2 yrs. plus 1 yr on request	upon lapse or 3 yrs
with consent	no	no	no	no	no	no
permit, agreement	agreement	expl. lic. north of 52°, concession	agreement	agreement	agreement	reserved area licence
no	yes	yes	yes	no	no	no

Figure 2. Development and pre-production (production not a condition)

	YUKON	NWT	B.C.	ALBERTA	SASKATCHEWAN
NAME	lease (of claim)	lease (of claim)	mining lease	metallic mineral lease	lease
Boundary survey	yes	yes	yes	no	not mandatory
Other conditions for obtaining	certif. of improvements ($500 spent, min. dep. found, post notice)	$10/ac spent or undertaken to commence prod'n	post & publish notice of intent	approved assess. report on permit	mark & tag bndry in unsurv. area
Size limits	1 claim	1 claim (max. 2582.5 acres)	none	min. 16 hectares max. 9216 hectares	16 to 6000 hectares L ≯ 6W
Term, renewal conditions	21 yrs. renewable if satisfy Min. that cond'ns of lease complied with	21 yrs. renewable indef. subj. to prescr. cond'ns	max. 30 yrs renewable once	Prim term: 10 yrs renew. for 15 yr terms	10 yrs renewable indef. subj. to compliance
Rent (annual, unless otherwise specified)	$50/1st term $200/2nd term	$1/ac less red'n to 50% for tren., strip, drill., ug	$5/ha if surveyed $250/ha if unsurveyed	$2.50/hectare	none
Annual work	none	none	none	$10/hectare if no production (primary term only)	yrs 1-10 $25/ha 11-20 $50/ha 21 + $75/ha

MANITOBA	ONTARIO	QUEBEC	N.B.	N.S.	P.E.I.	NFLD.
lease (1st & 2nd terms)	lease (of mining and surface rights)	claim	mineral claim	development licence	development licence	extended licence
yes — unsurv. area ? — surv. area	yes — unsurv. area ? — surv. area			no	no	no
$625/hr. spent, lesser amt subj to geol. and ecol.	compliance with mining act			suff. work to prove up mineral deposit	suff. work to prove up mineral deposit	compliance with terms of initial licence
max. 800 ha L ≯ 6W	none	see Figure 1	see Figure 1	max. 80 claims	max. 80 claims	none
21 yrs renew. once without prod'n if $1250 spent or prod'n on adj. lease or fully explored or prod'n unwarranted	21 yrs renewable indef. subject to compliance with act			1 year renewable indef.	1 year renewable indef.	one term max. 5 yrs
$7.50/ha, min. $80	term 1, yr 1 $1/acre yrs 2 +, .25/acre terms 2 +, 1.00/acre			$2/acre	$1/acre	$3/hectare
none unless needed for renewal	none			as prescribed by Minister	as prescribed by Minister	a) $600/claim a) $900/claim

F:gure 3. Production (production generally a condition)

	YUKON	NWT	B.C.	ALBERTA	SASKATCHEWAN
NAME	lease (3rd term +)	lease (of claim)	mining lease	metallic mineral lease	lease in relief period
Boundary survey	done previously	yes	yes	no	not mandatory
Other conditions for obtaining	as prescr. by Gov. in Council	$10/ac spent or undertaken to commence prod'n	post & publish notice of intent	authorization by O.I.C.	in prod'n or on standby or $1000/ha ug work done
Size limits	1 claim (per stage 2)	1 claim (max. 2582.5 acres)	none	min. 16 hectares max. 9216 hectares	16 to 6000 hectares L ⩾ 6W
Term, renewal conditions	21 yrs. renewable indef. per cond'ns prescr. by Gov. in Council	21 yrs. renewable indef. subj. to prescr. cond'ns	max. 30 yrs renewable once	15 yrs renewable	10 yrs renewable indef. subj. to compliance
Rent (annual, unless otherwise specified)	$200/term	$1/ac less red'n to 50% for tren, strip, drill, ug	$5/ha if surveyed $250/lease if not surv.	$2.50/hectare	$5/ha, min. $80
Annual work	none		none	none	none

MANITOBA	ONTARIO	QUEBEC	N.B.	N.S.	P.E.I.	NFLD.
lease (3rd term +)	a) min. surf rts lease b) patent (fee simple)	mining lease	mining lease	mining lease	mining lease	mining lease
done previously	done previously	yes	yes	yes	yes	yes if ground-staked
mining or on standby	can patent if 1 yr contin. production on lease	workable deposit, prod'n within 4 yrs	orebody outlined, prod'n decis'n made, submit feas. study and reclam'n program	prod'n plans for mining & reclam'n	prod'n plans for mining & reclam'n	prod'n within 5 yrs
max. 800 ha L ⩾ 6W (per stage 2)	none	max 100 ha, more if cond'ns warrant	As req'd for op'ns and prot'n of ore extens.	min. 1 claim max. 80 claims	max. 12 claims	none
21 yrs renewable indef. if in prod'n or on standby, treat ore in Canada	21 yrs renew. indef.	20 yrs, 3 renewals of 10 yrs each if mining in 2 of last 10 yrs/term; extension possible	20 yrs renewable to 80 yrs	20 yrs renewable so long as mine operat.	20 yrs renewable so long as mine operat.	1 st to 25 yrs renewable for terms to 10 yrs each
$5/ha, min. $80	a) tm 1, ur 1 $1/ac yrs 2 .25/ac tms 2 + $1/ac b) min acr tax .50/ac	public land $5/ha ($57/ha for tailings) priv. land $2.50/ha	$5/hectare	$2 acre	$1 acre	$40 hectare
none	none	none	$60/ha for any yr not in production	work or mining or both	work or mining or both	none

Figure 4. Summary of required work, years 1 to 10

		YUKON	N.W.T.	B.C.	ALTA.	SASK.	MAN.	ONT.	QUE.[2]	N.B.	N.S.	P.E.I.	NFLD.[2]	
Max. claim life Basic claim size		unlim. 51.65 ac	10 yrs variable	unlim. 25 ha	7 yrs variable	unlim. variable	unlim. variable	5 yrs 40 ac	unlim. 16 ha[3]	unlim. 16 ha	8 yrs 40 ac	5 yrs 40 ac	10 yrs 16 ha	
PART A	YR 1	100	$4/ac	100		0	0	20 days	500	100	200	$5/ac	200	
	2	100		100	$10/ha	$12/ha	$12.5/ha	40 days		150	200	$5/ac	250	
Required work as prescribed	3	100	$2/ac	100		$12/ha	$12.5/ha	40 days	500	200	200	$5/ac	300	
	4	100	$2/ac	200	$20/ha	$12/ha	$12.5/ha	40 days		250	200	$5/ac	350	
	5	100	$2/ac	200		$12/ha	$12.5/ha	60 days	500	300	200	$5/ac	400	
$/claim unless otherwise specified	6	100	$2/ac	200	$15/ha	$12/ha	$12.5/ha	—		300	200	—[4]	600	
	7	100	$2/ac	200	$15/ha	$12/ha	$12.5/ha	—	750	300	200	—[4]	600	
	8	100	$2/ac	200	$10/ha[1]	$12/ha	$12.5/ha	—		300	200	—[4]	600	
	9	100	$2/ac	200	$10/ha[1]	$12/ha	$12.5/ha	—	750	300	—[4]	—[4]	600	
	10	100	$2/ac	200	$10/ha[1]	$12/ha	$12.5/ha	—		300	—[4]	—[4]	600	
PART B	YR 1	77.5	80	64	53.3	0	0	—	250	100	200	200	200	AVG. 111.3
	2	77.5	80	64	53.3	192	200	—	250	150	200	200	250	156.1
	3	77.5	80	64	53.3	192	200	—	250	200	200	200	300	165.2
	4	77.5	80	128	160	192	200	—	250	250	200	200	350	189.8
	5	77.5	80	128	160	192	200	—	250	300	200	200	400	198.9
Required work converted to $40/ac or 16 ha	6	77.5	80	128	240	192	200	—	250	300	200	—	600	226.7
	7	77.5	80	128	240	192	200	—	375	300	200	—	600	239.2
	8	77.5	80	128	160	192	200	—	375	300	200	—	600	231.2
	9	77.5	80	128	160	192	200	—	375	300	—	—	600	234.7
	10	77.5	80	128	160	192	200	—	375	300	—	—	600	234.7
AVERAGE YRS 1-10		77.5	80	108.8	144	172.8	180	—	300	250	200	200	450	198.8

1. Maximum claim life is less than 10 years. Required work for a lease is used.
2. Data for a claim staked in unserveyed land.
3. In surveyed territory.
4. Not specified. At Minister's discretion.

Figure 5. Summary of Fees

		YUKON	N.W.T.	B.C.	ALTA.	SASK.	MAN.	ONT.	QUE.	N.B.	N.S.	P.E.I.	NFLD.	AVG.	
Individual Prosp. Licence $/year			5.00	25.00				5.00	25.00[2]	25.00[3]				—[1]	
Corporate Prosp. Licence $/year			50.00	500.00				25,50, 100		50,75,[3] 300				—[1]	
Set of claim tags $/claim		0	1.00	2.00		2.00	2.00	0	1.00	2.00			3.00	1.44	
$ per 40 ac or 16 ha	Record grnd. claim (unit)	7.74	4.00	3.20		10.00	—[1]	10.00	—[1]	5.00			5.00	6.42	5.98
	Grant map permit (lic)				—[1]				—[1]		4.00	5.00	4.80	4.60	
	Renew grnd. claim (unit)/yr	0	0	0		0	0	0	—[1]	12.00[4]			0		3.81
	Renew map permit (lic)/yr				0				—[1]		4.00	5.00	0		
	Fee to file work/yr	3.87	4.00	5.40[4]	0	0	—[1]	0	0	0	0	0	0		
Rent: licence or lease $/ha/yr	non-prod.	.23 tms 1& 2 .46 tms 3 +	2.47 max 2.47 max	5.00	2.50	0	7.50	.62 tm 1 N/A (patent)	—[1]	1.56[5]	4.94	2.47	3.00	2.76	
	prod.			5.00	2.50	5.00	5.00		5.00	5.00	4.94	2.47	40.00	7.08	

1. Data not amenable to reduction or averaging.
2. Valid for 5 years.
3. Valid for lifetime — no renewal fee.
4. Average of first 10 years.
5. Renewal fee for a claim, years 11 + .

DISCOVERY METHODS OF CANADIAN MINES

The Committee of Provincial Geologists has adopted a suggestion of the Prospectors and Developers Association's Geological Survey Committee, to undertake an ongoing project of documenting the discovery methods of Canadian mines. The aim of the project is to record the discovery method, and to track any trends that may develop with time, e.g. the relative success of one method over another.

This table will be an ongoing feature of the Journal. As well as working forward year by year, we intend to work backwards, initially to 1975 in the nest issue.

We welcome anecdotes on mines discoveries from our readers.

DISCOVERY METHODS FOR CANADIAN METAL MINES THAT OPENED IN 1987

PROVINCE	SASKAT-CHEWAN	MANITOBA	ONTARIO		NEWFOUNDLAND		BRITISH COLUMBIA
MINE	STAR LAKE 21 ZONE	PUFFY LAKE MINE	BELL CREEK MINE	GOLDEN ROSE	HOPE BROOK	ST. LAWRENCE	NICKEL PLATE
DISCOVERY NEW OR OLD	NEW	OLD	OLD	OLD	NEW	OLD	OLD
DATE OF ORIGINAL DISCOVERY (REASSESSMENT)	1983	1960 (1983)	1959	1897	1983	1843 (1933), (1977-83)	1897 (1984)
TECHNIQUE OF ORIGINAL DISCOVERY (REASSESSMENT)	DRILLING	GEOPHYSICS (EM), DRILLING (DRILLING)	PROSPECTING, DRILLING	PROSPECTING, TRENCHING, DRILLING	PROSPECTING, GEOLOGICAL	PROSPECTING (DRILLING, TRENCHING, UNDERGROUND DEVELOPMENT)	PROSPECTING, GEOLOGICAL, (GEOLOGICAL, DRILLING)
DISCOVERED RESERVES	210,000 t @ 17.1 g Au/t	3.9 MILLION TONS OF 0.23 OZ./TON Au			OPEN PITTABLE: 946,900 t, 6.6 g/t Au UNDERGROUND: 2,226,900 t, 6.3 g/t Au	4,240,509 t mined to 1977	2,987,046 t 41,637,105 g Au 4,163,138 g Au
REASSESSED RESERVES			886,160 t @ 0.189 oz Au/t proven, probable	2,500,000 t @ 0.237 oz Au/t		PROVEN, PROBABLE AND POSSIBLE *IN* 1977, 8.09 mt with cutoff grade 35% CaF2 to 300 m depth	6,439,700 t @ 5.14 g Au/t CUT-OFF 1.7 g Au/t
1987 PRODUCTION			9558 oz Au from 55,180 t	22,502 t @ 0.087 oz Au/t	OPEN PIT 275,000 t		AUG. '87 - END '87 333,814 t MILLED
MINING TYPE	UNDER-GROUND		UNDERGROUND	UNDERGROUND	OPEN PIT 1987-88 UNDERGROUND, POST 1988	UNDERGROUND OPEN PIT	OPEN PIT
MINING RATE	200 t/day		MILLING RATE 350 tpd	MILLING RATE 400 tpd	OPEN PIT 1700 t/d UNDERGROUND 3000 t/d	NOT AVAILABLE MILL CAPACITY: 1000,000 tpy CONCENTRATE	2500 t/day
COMMODITIES	Au	Au	Au	Au	Au	F1	Au, Ag, Cu, As, Co, Bi
DEPOSIT CLASSIFICATION	VEIN		VEIN	VEIN	EPITHERMAL? SHEAR-RELATED?	VEIN	SKARN
KEY REFERENCE	SMDI 889b		METALS ECONOMICS GROUP 1988	METALS ECONOMICS GROUP 1988	MODS 110/9 AU003	MODS 1L/14 F1001-045 INCL.	MI 92H/SE-038 NMI 92H/8 - AU2

GEOLOGICAL ATLAS OF THE WESTERN CANADA SEDIMENTARY BASIN — A MULTI-INSTITUTIONAL, MULTI-DISCIPLINARY COMPILATION

Grand D. Mossop
Alberta Geological Survey[1]

INTRODUCTION

The Western Canada Sedimentary Basin is remarkable in two essential regards. First, there is superb natural exposure of practically all of the basin strata in the Rocky Mountain thrust belt. Pre-orogenic Proterozoic to Jurassic passive margin strata of the continental terrace crop out extensively in the imbricate thrust slices that dominate the various ranges of the Canadian Rockies. Syn-orogenic Jurassic to Tertiary rocks of the foreland basin, that formed cratonward of the eastwardly advancing thrust belt, are extensively exposed in the Front Ranges and Foothills region. The availability of two- and three-dimensional surface exposure in the deformed belt is a tremendous boon to the stratigrapher/sedimentologist (not to mention the structural geologist/tectonist), for internal facies transitions and even large-scale elements of stratigraphic architecture can be literally walked out and mapped. Such control is not available to the subsurface geologist, who is constrained by the one-dimensional nature of the borehole. The natural field laboratory of the deformed belt thus allows for otherwise unachieveable insights not only into the nature and origin of the rocks themselves but also into the close tectono-stratigraphic interrelationship between the Rockies and the associated sedimentary strata of the undeformed craton (see Porter, Price and McCrossan, 1982).

Second, the subsurface component of the Western Canada Sedimentary Basin is amongst the most comprehensively explored and documented in the world. In point of fact, the density of drill hole control is not particularly exceptional. What is exceptional is that comprehensive data from virtually all of the wells in western Canada are publicly available. Governments in the west showed remarkable foresight when they structured the conservation boards and related government jurisdictions in the 1940's. The guiding principle they have espoused from the beginning is that all logs, cuttings and cores from oil and gas wells must be released, typically after a proprietary period of one year, for examination and interpretation by any interested party — be they industry competitors, academics or government scientists. There can be absolutely no doubt that the *available* database of information on the subsurface of the Western Canada Sedimentary Basin is truly unparalleled in the world, both in nature and in scope.

Given the exceptional character of both the surface and the subsurface control in the west, and acknowledging the importance of appropriate conceptual integration of the Cordilleran and cratonic realms, it is clear that the Western Canada Sedimentary Basin is an ideal candidate for comprehensive tectono-stratigraphic synthesis and basin analysis. This paper sets out the essentials of our project to conduct such a regional synthesis, and to publish a new *Geological Atlas of the Western Canada Sedimentary Basin*. It is a complex undertaking — truly multi-institutional and multi-disciplinary in scope.

HISTORY AND PROJET DEVELOPMENT

From its fledgling beginnings in the early part of this century, spurred considerable by the discovery of Leduc in 1947, the Canadian oil industry has grown progressively to higher and higher levels of maturation. By the early 1960's there was sufficient borehole control in the basin to establish the basic stratigraphic framework. A group of farsighted industry, government and academic geologists in the Alberta Society of Petroleum Geologists (now the Canadian Society of Petroleum Geologists) banded together to undertake a comprehensive regional synthesis of the entire Phanerozoic succession in the basin. The result was the production of the first "Atlas" of western Canada — the *Geological History of Western Canada*, edited by McCrossan and Glaister (1964). By any standards, it was a landmark publication, later emulated in various other parts of the world.

1. Mailing address — Alberta Research Council, P.O. Box 8330, Stn. F, Edmonton, Alberta, T6H 5X2 (403)438-7657

Since the early 1970's, there have been a number of attempts on the part of individuals within the Canadian Society of Petroleum Geologists (CSPG) to organize the compilaton of a new geological atlas for western Canada. These have repeatedly floundered. The difficulty seems to have been that, although there has always been a relatively large bank of individuals ready to contribute to the compilation, there has been a singular lack of success in identifying individuals who could secure employer support for the dedication of four of five person-years to proper project management and editing.

By the early 1980's, there was still no concrete move toward the compilation of a new Atlas, but demand remained, and copies of the old Atlas became collectors items. A reprinting was seriously considered. The initiative collapsed, however, because it was discovered that the original plates had deteriorated beyond use, and that re-creating them would involve prohibitive unit costs.

The present initiative to compile and produce a dynamic new atlas of the Western Canada Sedimentary Basin is based on the precept that success is possible only if the project is managed effectively at its core, in a reliable, through-going fashion, coupled of course to ultimate reliance on multitudinous volunteer contributors to conduct the basic geological syntheses.

Imperial Oil served as the hub of the project in the 1960's. This time, with the commitment of support from a broad range of private and public sector constituencies, the core of the Project lies in the government realm.

Geologists throughout the west are again actively involved in taking stock of their basin in a truly regional context. There is optimism that, with the application of modern computer techniques and the application of thoughtfull standards in the systematic geological characterization, the job can be done efficiently and effectively.

BACKGROUND RATIONALE

In the years since publication of the first Atlas, the database of wells in western Canada has increased many fold. The resolution and reliability of subsurface information has been subject to quantum advancements. Geologic ideas on the stratigraphic and structural evolution of the basin have been revolutionized, most centrally by the concepts of plate tectonics, which were not widely accepted at the time of compilation of the first Atlas. In addition, there has been very considerable evolvement in basin analysis techniques that embrace previously uncharted concepts of basin architecture, seismic stratigraphy, sedimentation patterns and facies relationships, thermal/organic maturity, and regional hydrodynamic reconstruction.

The essence of the Atlas concept is the provision of a regional perspective on the basin, for reference in the early stages of new exploration plays and resource development projects in the energy and mineral industries, and also for a multitude of applications in academia and government. The production of a new and dynamic atlas is envisaged as a significant spur to increased effectiveness in all of the studies that rely on an atlas background. Rendered flexible by the availability of a readily updated computer database, the new Atlas should serve as a standard reference for decades to come.

OBJECTIVES

A goal of the Atlas Project can be stated as follows: As a community of geologists in western Canada, to compile and produce a new atlas of the subsurface geology of the Western Canada Sedimentary Basin.

There are two output objectives:

1) to establish an electronic database of consistently interpreted subsurface information, with associated software; and

2) to produce a printed volume, published jointly by the Canadian Society of Petroleum Geologists and the Alberta Research Council.

Key output elements for each of the 19 designated stratigraphic "slices" include:

— maps (1:5,000,000) — structure, isopach, lithofacies, paleogeology, basic paleogeography
— cross-sections — regional, log based
— type logs and type cross-sections
— stratigraphic correlation charts
— text, with integrated or separate chapter treatment of those geological, geophysical, geochemical and geotechnical parameters that are inherent in a modern basin analysis

In addition to the 19 chapters dealing with specific stratigraphic intervals, there will be chapters on the overall evolution of the principal "tectonic domains" — Peace River Arch, Alberta Basin, Sweetgrass Arch and Williston Basin; and on certain "theme" elements — overall tectonic framework, hydrogeology/geothermics, thermal/organic maturity and economic geology/resources.

The geographic limits of the Atlas are — the Canada/U.S. border to the Tathlina Arch in the southern Northwest Territories, and the Precambrian Shield edge in the east to the Foothills and Canadian Rockies in the west. Mapping in the disturbed belt will be concentrated in stratigraphic zones where proper palinspastic restoration can be achieved.

ATLAS PROJECT STRUCTURE

Project Sponsors

Project Sponsors are identified as "institutions formally committed to the success of the project, and bearing financial responsibility for core support". There are four Project Sponsors (figure 1), each of which exercises a measure of reporting and accountability control, and all of which are drawn together through representation on the Management Committee. The Atlas Management Committee bears overall responsibility for strategic decisions relating to the project, and is involved in overseeing financial aspects and schedule regulation.

Data Donors

From the outset, it was resolved that, rather than contemplate picking every well anew, the Atlas compilation would be based upon existing electronic data files, modified and restructured in accordance with the iterative input of each of the chapter teams. The original databases, which represent a commercial value of many hundreds of thousands of dollars, have been contributed to the Atlas Project by the Data Donors. Figure 2 itemizes the data and donors involved.

Atlas Project Sponsors*

	Management Committee Representative
Alberta Energy/Alberta Forestry, Lands and Wildlife	Michael Day
Alberta Research Council	Jan Boon
Canadian Society of Petroleum Geologists	Jim Dixon
Geological Survey of Canada	Walter Nassichuk

* Institutions formally committed to the success of the project and bearing financial responsibility for core support.

Figure 1. Atlas Project Sponsors

Atlas Data Donors*

Subsurface Stratigraphic Data	Donors
– Alberta	Energy Resources Conservaton Board
– Saskatchewan	Saskatchewn Energy and Mines
– Manitcba and British Columbia	Chevron Canada/Digitech
Subsurface Lithology Data	Canadian Stratigraphic Service/Home Oil
Hydrogeological Data	Canada Institute of Formation Evaluation
Structural/Palinspastic Data	Shell Canada

* Institutions and corporations that have contributed important basic data to the Atlas compilation.

Figure 2. Data Donors

Contributors

Each chapter in the Atlas is the responsibility of a team of two to nine individual earth scientists. The leadership and composition of teams for the 19 chapters dealing with "stratigraphic slices" have been largely determined. Formulation of the teams for the "tectonic domain" and "theme" chapters is not yet complete, but a large number of volunteers have come forward.

Figure 3 lists the presently confirmed contributors, in the context of the chapter structure of the Atlas. In total, there are some 90 geologists committed to involvement as contributors, and the numbers continue to grow.

Ultimately, all contributors to the Atlas have a voice in influencing the scientific approach of the project. This is manifest in countless informal ways, but is drawn together in the meetings of the Contributors Assembly — a kind of "parliament" for the deliberation and ratification of fundamental technical matters. As it is clearly impractical to involve such a large group of people in technical decisions beyond the most fundamental level, responsibility of immediate scientific direction is vested in the Steering Committee (figure 3). The Atlas Steering Committee consists of senior Advisers and Coordinators, who in addition to their ongoing role in providing scientifc leadership are also charged with serving as Associate Editors of the printed Atlas.

Project Staff

Overall project management is localized in the Alberta Research Council, with operational responsibility vested in the office of the Atlas Project Manager. The headquarters staff members are listed in figure 4.

Practically all of the electronic data processing for the project, including virtually all of the software development, is handled by Irina Shetsen, with the support of the Alberta Geological Survey's Department Computing Group. Jiri Losert is an Alberta Energy geologist seconded to the Atlas Project for the purposes of compiling the detailed regional cross-sections upon which most of the fundamental stratigraphic decisions are based. Myriad tasks associated with technological and geological support for the project are discharged by Mika Madunicky and Dermot O'Shea.

A number of other Alberta Research Council staff members are involved in the work of various Atlas chapter teams, on a basis not dissimilar to that of other contributors. The only chapter that is being compiled in-house by Alberta Research Council staff is that dealing with Hydrogeology/Geothermics, under the direction of Brian Hitchon.

Atlas Chapters/Contributors

Quaternary	
Mark Fenton – Leader	Alberta Research Council
Ted Connolly	Etcetera
Foreland Basin	
Dave Smith – Co-ordinator	Canadian Hunter
Uppermost Cretaceous – Tertiary	
Emlyn Koster – Leader	Tyrrell Museum of Palaeontology
Tom Jerzykiewicz	Geological Survey of Canada
Grant Smith	Geological Survey of Canada
Rick Marsh	Energy Resources Conservation Board
Hugh Hendry	University of Saskatchewan
Art Sweet	Geological Survey of Canada
Mike Dawson	Geological Survey of Canada
Kimberley Safton	
Gary Diakiw	Alberta Geological Survey
Rick Richardson	
Cretaceous Colorado/Alberta	
Dale Leckie – Leader	Geological Survey of Canada
Cardium	
Fed Krause – Leader	University of Calgary
Don Keith	Alberta Geological Survey
Dunvegan	
Janok Battacharya – Leader	McMaster University
David Safton	Sage Geological
Viking	
Catherine Szata	Sage Geological
Margaret Hanna	
Blairmore/Mannville	
Jim Christopher – Leader	Saskatchewan Energy and Mines
Brad Hayes	Canadian Hunter
Doug Minken	Maryanne Petroleum
Brent McKercher	Knee Hill Energy
Jonathan Fennel	
Jurassic-Kootenay	
Terry Poulton – Leader	Geological Survey of Canada
Jim Christopher	Saskatchewn Energy and Mines
Brad Hayes	Canadian Hunter
Jiri Losert	Alberta Energy
Joan Tittemore	
Carboniferous/Permian/Triassic	
Triassic	
Dan Edwards – Leader	Krishelle
Eleanor Halton	Pan Canadian
Jim Barclay	Geological Survey of Canada
Dave Gibson	Geological Survey of Canada

Figure 3. Contributors

Permian	
Charles Henderson – Leader	University of Calgary
Barry Richards	Geological Survey of Canada
Carboniferous	
Barry Richards – Leader	Geological Survey of Canada
Charles Henderson	University of Calgary
Fred Trollope	Pan Canadian
Alf Hartling	Geological Survey of Canada
Kirk Ozadetz	Geological Survey of Canada
Jim Barclay	
Devonian	
Ian McIlreath – Co-ordinator	PetroCanada
Wabamun/Palliser	
Henk Halbertsma – Leader	Geological Survey of Canada
Nic Meijer-Drees	
Winterburn	
Nigel Watts – Leader	Alberta Energy Company
Steve Swtizer	Chevron
Jeff Packard	Texaco
Woodbend	
Tim Marchant – Leader	Amoco Canada
Beaverhill Lake/Souris River	
Walter Keith – Leader	Saskatchewan Energy and Mines
Dave Lane	Canadian Stratigraphic Service
Katy Ma	
Elk Point	
Nic Meijer-Drees	Geological Survey of Canada
Nancy Wilson	Esso
Lower Paleozoic	
Don Kent – Co-ordinator	University of Regina
Middle Ordovician–Silurian	
Brian Norford – Leader	Geological Survey of Canada
Mike Cecile	Geological Survey of Canada
Fran Haidl	Saskatchewan Energy and Mines
Middle Cambrian–Middle Ordovician	
Lee Slind – Leader	Geological Survey of Canada
Doug Paterson	Saskatchewan Energy and Mines
Glen Andrews	Shell Canada
Proterozoic–Lower Cambrian	
Fran Hein – Leader	Dalhousie
Precambrian Basement	
Ron Burwash – Leader	University of Alberta
John Wilson	Alberta Geological Survey

Figure 3. Continued

Steering Committee

Chairman	Grant Mossop	Alberta Geological Survey
Adviser	Andy Baillie	Retired
Adviser	Perry Glaister	Retired
Lower Paleozoic Coordinator	Don Kent	University of Regina
Devonian Coordinator	Ian McIlreath	PetroCanada
Foreland Basin Coordinator	Dave Smith	Canadian Hunter

Contributors for Domain and Theme Chapters

Domain Chapters		
Peace River Arch		
Sweetgrass Arch		
Williston Basin		
Alberta Basin		
Theme Chapters		
Tectonic Framework	Stefan Bachu	Alberta Geological Survey
Hydrogeology/Geothermics	Sebastian Bell	Geological Survey of Canada
Thermal/Organic Maturity	Sherry Carroll	CICO
Geophysics	Jim Christopher	Saskatchewan Energy and Mines
Geotechnical/Engineering	Jeffrey Freeman	Geological Survey of Canada
Economic Geology/Resources	Helmut Geltsetzer	Alberta Geological Survey
	Brian Hitchon	University of Alberta
	Walter Jones	University of Regina
	Don Kent	North Canadian
	Gerald Kvill	Alberta Geological Survey
	Andre Lytviak	Canterra Energy
	Michael Marchand	Energy Resources Conservation Board
	Rick Marsh	Geochem
	Theodora Masran	Shell Canada
	Pat McLellan	Shell Canada
	Bob McMechan	Geological Survey of Canada
	Jim Podruski	Geological Survey of Canada
	Ray Price	Alberta Geological Survey
	Rick Richardson	
	Volkmar Schmidt	
	Frank Staplin	Dalhousie University
	Richard Trotter	Alberta Geological Survey
	Jim Underschultz	University of Regina
	Laurence Vigrass	Summus
	Gordon Williams	Cal-Cad
	Andrew Zolnai	

Figure 3. Continued

Atlas Project Staff – Alberta Research Council

Master Atlas	
Project Manager	Grant Mossop
Computing Specialist	Irina Shetsen
Project Geologist	Jiri Losert*
Project Technologist	Mika Madunicky
Student Geologist	Dermot O'Shea

* seconded from Alberta Energy

Atlas Hydrogeology	
Principal Investigator	Brian Hitchon
Fluid/Heat Flow Specialist	Stefan Bachu
Project Hydrogeologist	Jim Underschultz
Computing Specialist	Andre Lytviak
Project Technologist	Mika Madunicky
Computing Technologist	Michel Brulotte

Figure 4. Atlas Project Staff

Internal accountability for the project is manifest through line structures in the Basin Analysis and Petroleum Geology Group, Alberta Geological Survey, Natural Resources Division, to the Research Committee of the Alberta Research Council, and ultimately to the Alberta Research Council Board of Directors.

Patrons

A number of corporate bodies have undertaken to support the Canadian Society of Petroleum Geologists in their underwriting of printing costs for the published Atlas volume. A listing of these Patrons is set out in figure 5.

Budget and expenditures

Atlas-related activities take place in literally dozens of offices throughout western Canada. It should be emphasized that the vast majority of these activities involve expenditure of time and money that is contributed to the project by individuals and their employers. Full accounting for these expenditures is an elusive matter, but over the life of the project they are estimated to amount to dollar equivalents equal to some three or four times that of the "core" budget of the budget.

Atlas Patrons*

Petro-Canada
Texaco Canada Resources
Esso Resources Canada
Husky Oil Operations
Mobil Canada
Norcen Energy Resources
Shell Canada
Unocal Canada
Amoco Canada Petroleum
BP Resources Canada
Chevron Canada

* Corporations that have expressed willingness to financially support the CSPG in underwriting Atlas printing costs.

Figure 5. Project Patrons

Budget and expenditure figures for this "core" are set out in figure 6. They show that, to the end of fiscal year 1987/88, the project was within budget. On the basis of experience to date, it would appear that sufficient monetary resources are committed to the project to allow for satisfactory completion in 1991.

Expenditure and Revenue ($000)
Budget/***Actual***

	Phase I		Phase II					Totals
	July 85–Dec 86		Jan 86–Mar 87		1988/89	1989/90	1990/91	
Expenditure								
Supplies and Services	6.8	***5.4***	40.4	***18.1***	45.0	18.0	22.0	**108.5**
Fixed Assets	4.0	***1.3***	28.0	***23.0***	10.0	–	–	**34.3**
Transfer Costs								
Computing	4.0	***4.2***	34.0	***24.6***	40.0	40.0	25.0	**133.8**
Drafting	2.0	***2.5***	5.0	***3.8***	5.0	110.0	70.0	**191.3**
Editing	0.5	***0.3***	0.8	–	1.8	4.0	12.0	**18.1**
Printing	0.5	***0.6***	–		–	–	160.0	**160.6**
Manpower and Overhead	83.2	***85.1***	284.6	***267.3***	208.7	185.0	109.3	**855.4**
Total Expenditure	101.0	***99.4***	392.8	***336.8***	310.5	357.0	398.3	**1502.0**
Revenue								
Alberta Research Council	101.0	***99.4***	213.8	***181.8***	200.5	132.0	48.3	**662.0**
Alberta Energy	–	–	179.0	***155.0***	110.0	115.0	120.0	**500.0**
CSPG	–	–	–	–	–	–	160.0	**160.0**
Drafting (AE)	–	–	–	–	–	110.0	70.0	**180.0**
Total Revenue	101.0	***99.4***	392.8	***336.8***	310.5	357.0	398.3	**1502.0**

Figure 6. Budget and Expenditures

SCHEDULE AND WORKPLAN

The overall schedule and workplan for the Atlas Project is outlined in figure 7. The Phase I feasibility study (July 1985-December 1986) involved the marshalling of resources and support to the threshold of a "Go/No Go" decision on whether or not to proceed with the actual compilation. The study concluded that "the production of a new Geological Atlas of the Western Canada Sedimentary Basin appears to be technically, strategically and financially sound" (Mossop, 1986), and a "Go" decision was taken by the Project Sponsors.

Atlas Workplan

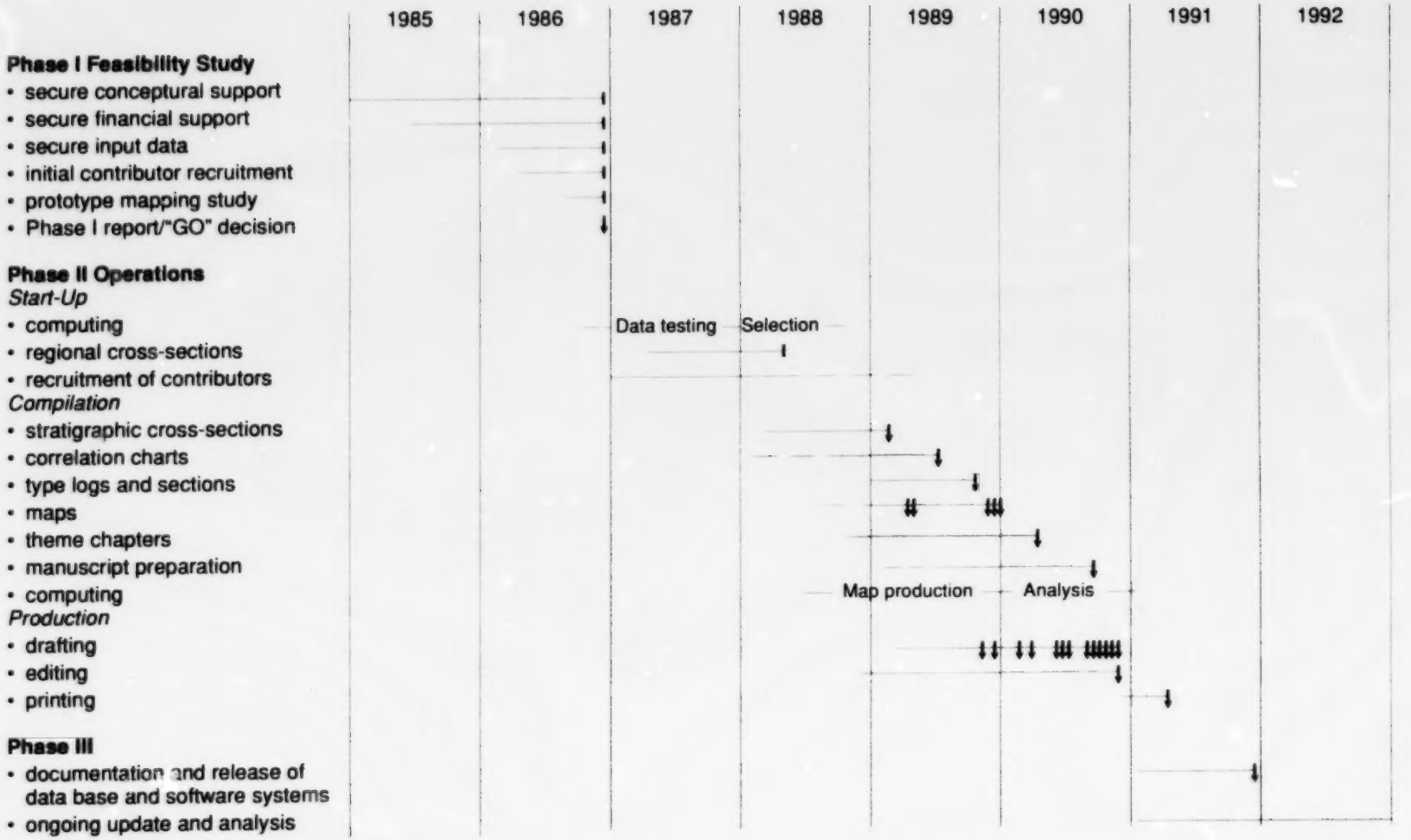

Figure 7. Atlas Schedule and Workplan

The Phase II compilation was initiated in early 1987, with publication of the printed Atlas scheduled for the spring of 1991.

The first year of Phase II was devoted to:

1) implementation and testing of the electronic databases that constitute the basic input into the mapping,
2) design and programing of an automated system for processing voluminous amounts of subsurface data;
3) design and testing of programs for the optimization of control points selection and for establishment of subsurface stratigraphic equivalents;
4) completion of initial master cross-sections, across the basin and along its axis; and
5) additional recruitment and consolidation of contributors into chapter teams.

Year two (1988-89) is being devoted to completion of the cross-section work, resolution of problematic correlations, establishment of stratigraphic tables and correlation charts, initiation of computer mapping, and processing of subsurface lithologic data.

Year three (1989-90) will see completion of most of the basic maps, initial application of map analysis techniques, consolidation of the information that is necessary input into the "theme" and "tectonic domain" chapters, and initiation of manuscript preparation.

Early in year four (1990-91), Atlas Project results will be presented for scrutiny and discussion at the annual conference of the Canadian Society of Petroleum Geologists. This will be followed by final review and editing prior to going to press at Christmas, 1990. It is expected that the printed Atlas will be published in March, 1991, with release of the digital Atlas database later that year or in early 1992.

A contemplated Phase III is envisaged as an ongoing endeavour, involving continuous updating and modernization of the Atlas database and the associated software (figure 7). If it is approved by the Project Sponsors, it will result in the realization of a "living atlas" concept.

SUMMARY AND CONCLUSIONS

The project to compile a new Geological Atlas of the Western Canada Sedimentary Basin is a complex endeavour involving multi-disciplinary, multi-institutional cooperation. The 1988 perspective, about a third of the way through the operational phase of the compilation, is that the Atlas Project is based on sound background rationale and that it embraces meaningful and achieveable objectives. The key components of its current status are that:

1) core funding for the project is in place through the support of Project Sponsors;
2) digital data files on subsurface stratigraphy, lithology and other important parameters have been contributed to the project by the Data Donors and are installed on the Alberta Research Council computing facilities;
3) an electronic data processing system has been designed and developed for the integration of data sets and derivation of a wide range of controlled output;
4) the complement of Atlas contributors has grown to 90, and the makeup of 19 of the 29 chapter teams has been established;
5) detailed log cross-sections, across the basin and along its axis, have been completed, allowing for elucidation and resolution of key correlation questions; and
6) a systematic network of committees and reporting structures has been established, allowing for appropriate levels of project accountability.

In all essential regards, the compilation of the new Geological Atlas of the Western Canada Sedimentary Basin remains a technical, strategically and financially sound undertaking.

DISCUSSION

The concept on a geological atlas has always been the "intellectual property" of the CSPG, and their support for the current initiative has been unstinting from the very begining. It must be emphasized that the vast majority of effort in this project is in the form of contributed technical input on the part of volunteer geologists, with the support of their employers. Practically all of this effort has been mobilized through the CSPG. In addition, the CSPG has undertaken the not inconsiderable financial burden of underwriting the printing costs of the published volume. They have accordingly solicited and received the backing of numerous corporate bodies — the Project Patrons.

Notwithstanding any of the above, it is clear that various government jurisdictions are this time playing an absolutely central role in the Atlas undertaking. Three of the Project Sponsors are government bodies — Alberta Energy, Alberta Research Council and the Geological Survey of Canada. The project is managed in one of the provincial geological surveys — the Alberta Geological Survey. Government surveys have committed very considerable resources of essential data and manpower to the conduct of the project. The leadership provided by government is essential to project success.

In the final analysis, then, the compilation of a new Geological Atlas of the Western Canada Sedimentary Basin is a complex cooperative endeavour involving dozens of individual contributors: geologists working in industry, government and academia; and a large number of institutions and corporations — Project Sponsors, Data Donors, Patrons and Contributors' Employers. The degree of sucess that the Atlas Project achieves will be a direct reflection of the degree of goodwill and cooperation that can be sustained amongst all the parties.

As the project matures, there remains very considerable scope for input from new sources. Enquiries about any aspect of the proejct are most welcome. Additional information on the project is contained in the Phase I feasibility report (Mossop, 1986) and in the 1987/88 Annual Report of the project (Mossop, 1988).

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